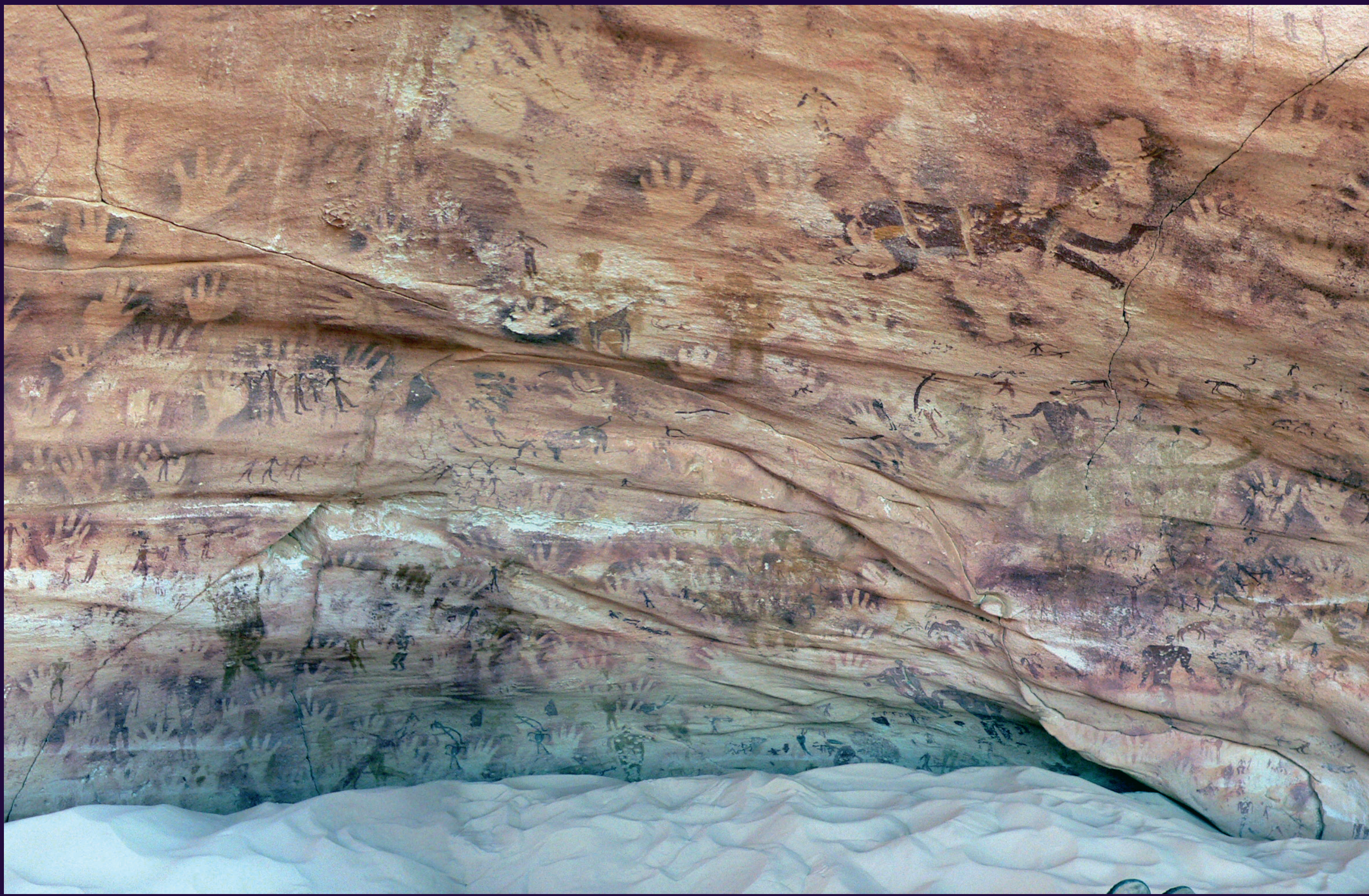
McDONALD INSTITUTE CONVERSATIONS

Social inequality before farming?

Multidisciplinary approaches to the study of social organization in prehistoric and ethnographic hunter-gatherer-fisher societies

Edited by Luc Moreau



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with contributions from
Hervé Bocherens, Alberto Buela, Andrea Czermak, Christophe Darmangeat, William Davies, Mark Dyble, Kate Ellis-Davies, Ben Fitzhugh, Douglas P. Fry, Mietje Germonpré, Matt Grove, Emmanuel Guy, Brian D. Hayden, Rowena Henderson, Emmanuelle Honoré, Joe L. Jeffery, Charles A. Keith, Marta Mirazón Lahr, Noa Lavi, Robert H. Layton, Martina Lázničková-Galetová, Julia Lee-Thorp, Sheina Lew-Levy, Paul Pettitt, Rachel Reckin, Paul Roscoe, Mikhail V. Sablin, Rick J. Schulting, Patrik Söderberg, Duncan N.E. Stibbard-Hawkes, Ilga Zagorska, Gunita Zarina

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Preface

I write this preface from the state of Wyoming in the US, a state where COVID-19 has not (yet) struck as hard as it has struck other parts of the world, but where we nonetheless have been under stay-at-home orders. Those orders have given me plenty of time to think about where we went wrong, which in the case of the US is a long list. Coincidentally, I also recently re-read Machiavelli's sixteenth-century book, *The Prince*, a manual of how to ruthlessly crush opponents while administering (apparent) generosity to acquire the 'love' of the masses.

It was in this context that I read the papers in this volume. In doing so, I was struck by two facts. First, inequality's origin, development and operation are difficult to understand and yet the actions that lead to inequality are easy to implement. This shouldn't surprise us: no American baseball player mathematically calculates the arc of a fly ball, but he's still able to position himself in the right place to catch it. You can be utterly uneducated and still know how to manipulate a system to maintain exert, and abuse power. Many world leaders today are proof.

Second, I think that the papers in this volume could be some of the most valuable published in anthropology in many years. Philosophers and social thinkers have tried to understand inequality for a century; indeed, efforts to understand it precede Machiavelli. We bemoan its existence, and yet we have felt unable to grasp it, and, unable to grasp it, unable to do something about it. We muddled through the useless ramblings of nineteenth- and early twentieth-century evolutionists, who, reflecting their colonial environment, often thought that inequality was a good thing, and, if not good, an inevitable thing. Marx tried to shake them out of that complacency, but his brilliance was largely wasted during his 'second coming' in the second half of the twentieth century with so much hand-wringing about how a theory intended to explain early capitalism should also apply to hunter-gatherers (because, it must… right?), and so much politically correct posturing that led to no action – and all but disappeared when the Berlin Wall (thankfully) came down and the Soviet Union collapsed. 'Intensification' and 'complexity', words that should be stricken from anthropology's vocabulary for their uselessness (and that are thankfully rare in this volume), masked what was really going on: exploitation, oppression, slavery… inequality in all its manifestations. Finally, I think, we have reached the point, through analyses of archaeological and ethnological data, that we might actually understand inequality.

We've passed a Rubicon. And this really matters.

The calamity that is COVID-19 has pulled back the curtain on modern society, exposing the weaknesses of its structure, laying bare the inequality between and within countries that Machiavellian leaders exploit and exacerbate for personal gain. Doing something about inequality is the challenge that will remain after COVID-19 dissipates.

These papers help by seeking the origin of inequality in a kind of society, that of nomadic hunter-gatherers, that we once considered 'the original affluent society', a classless society, or 'primitive communists'. Some argue that inequality must be there (as Marxist analysts argued in the 1980s) since it is present in our closest primate relatives, and therefore is in humanity's genetic foundation. Some see evidence of social and/or political inequality among Palaeolithic hunters, in the evidence for secret societies and in the violence of cave art. I am not convinced by this 'grimdark' vision of Palaeolithic society, and see an enormous gap between difference and inequality, between a situation where one person has more than another who nonetheless has enough and one in which society gives a person permission to enslave another.

Nonetheless, these chapters remind us that hunter-gatherers are not angels, and the same self-interest that guides an Iñupiaq man to become a *umialik*, or that gave privilege to those men allowed to gather in the torch-lit gallery of Lascaux, guides Machiavelli's anonymous prince. People have different skills, and for some, those skills are political. Under the right conditions, those individuals can consolidate power, convince others to go to battle, and make their personal aggrandizement seem reasonable to the people paying its price. Palaeolithic society had its Hitlers and Stalins, its Caesars and Trumps.

But it didn't have imperialism, or empires, or palaces, or wealth hidden in tax havens. So other chapters here look for the conditions under which those 'selfish' individuals can gain power. High population density (pressure), localized and hence controllable resources, the ability to build a coalition, which requires a sufficient concentration of population and social institutions that are conducive to creating coalitions, lack of trust in institutions, including sharing networks, to provide in times of stress – these are the conditions that permit those with political skills to pursue self-interest through the manipulation of others.

These conditions are as relevant to understanding the world of today as they are to an understanding of the Palaeolithic world. Today, however, conditions can be manipulated, for example 'localized' in off-shore bank accounts. Population pressure is high and will become worse as the world approaches the projected population of 11 billion by 2100. And competition is worsened by a capitalist economy that encourages ever-increasing amounts of consumption and conversion of needed resources, such as food, into higher profit margin items such as crisps and alcoholic beverages. Information is a resource, and technology makes information more available but less trustworthy. Unbelievably expensive displays of potential force – multi-billion-dollar aircraft carriers, atomic weapons, a Space Force – signal a lack of trust in non-violent institutions to resolve the inevitable disputes that arise when people, or countries, pursue their self-interests with little regard for others. Building trust in institutions – in the UN, in voting, in the media, in government itself! – is an integral part of stopping and even reversing the arms race before it drives the world to the poor house.

Inequality is an old story, and one that we understand much better due to the efforts of anthropologists and archaeologists. It hasn't been easy to arrive at this point. But the really hard work – implementing our knowledge – still lies ahead for us. This volume, and our prehistoric hunting and gathering ancestors tell us what needs to be done. And it is the most important work anyone could be doing in the world today.

Robert L. Kelly
University of Wyoming

Introduction

Social inequality without farming: what we can learn from how foraging societies shape(d) social inequality?

Luc Moreau

Today, as unfair inequality threatens civil society (Case & Deaton 2020; Deaton 2016), understanding the evolutionary development, intergenerational transmission, and variable levels and forms of social inequality through time and space is one of archaeology's fundamental tasks and current 'Grand Challenges' (Kintigh et al. 2014; Price & Feinman 2010; Smith et al. 2010a,b,c). By revealing a far more complex human past than previously postulated by social philosophers and early proponents of social evolutionary theories (Childe 1951; Fried 1967; Service 1966), archaeological investigations over the past 50 years have challenged the importance of domestication and food production *per se* in the emergence of institutionalized social inequality (Flannery & Marcus 2012; Kohler & Smith 2018; Price & Brown 1985; Price & Feinman 1995, 2010). Longstanding assumptions about social evolution from egalitarian foragers towards non-egalitarian farmers following simple staged models have further been falsified by ethnographic and archaeological data. These show that wealth and status disparities are not ubiquitous among farmers and horticulturalists (Bogaard et al. 2019; Gurven et al. 2010; Kuijt 1996), and conversely, that inequalities in wealth and status exist in purely foraging economies (Ames 2007; Fitzhugh 2003, this volume; Hayden 1994, 1995, this volume; Roscoe 2006, this volume).

Social inequality in the prehistoric human past developed through multiple historical processes that operate on a number of different scales of variability (e.g. social, economic, demographic, and environmental) (e.g. Drennan et al. 2010; Fitzhugh 2003, this volume; Kelly 1995, 2013: 241–68; Mattison et al. 2016; Price & Feinman 1995; Smith et al. 2018). This volume, focusing on the archaeology and ethnology of social inequality in foraging societies, reflects an expanding interest in empirically unravelling those correlations rather than assuming them at the outset.

This volume contains research presented at an international conference held at the McDonald Institute for Archaeological Research (University of Cambridge) from 21 to 23 January 2018, bringing together early-career researchers and world-renowned scholars in the fields of prehistoric archaeology and evolutionary anthropology. The conference aimed to advance discussions that address variability in the pattern and process of social inequality in non-agricultural societies, and to promote social narratives about lifeways in prehistoric hunter-gatherer-fisher communities. Contributors to this volume seek to identify and interpret the archaeological correlates of social inequality in its diverse manifestations, to adapt and refine theoretical ideas and to investigate the conditions that allowed hierarchical forms of economic, social, and political organization to take hold and persist in hunter-gatherer-fisher societies (in short: hunter-gatherers), both prehistoric and 'extant'. Under this term, I include the set of societies which have been ethnohistorically or ethnographically recorded but are no longer in existence exactly as they were recorded, even though that is stretching the meaning. These contributions draw on multidisciplinary cross-cultural case studies spanning terminal Pleistocene to Holocene archaeological and ethnographic contexts from across the globe.

Understanding social inequality

The evolution and deployment of social inequality in its multiple forms and degrees is a complex topic, not served well by simplistic definitions (e.g. Borgerhoff Mulder et al. 2009; Fitzhugh 2003, this volume; Kelly 2013; Mattison et al. 2016; Roscoe 2006, this volume; Smith et al. 2010a,b). In all human societies, individuals of different ages, genders or abilities receive different shares of the overall economic output, hence enjoy different degrees of autonomy, prestige, or power within the group (Henrich & Boyd 2008; Kelly 2013; Sahlins 1958). Moreover, according to Smith et al. (2010a), almost no extant hunter-gatherer society is characterized by pervasive equality in wealth and life chances – however egalitarian in the terms of Woodburn (1982) its ethos may be. In this sense, inequality is practically ubiquitous.

In the theoretical and linguistic landscape of social inequality, there is no ultimate definition of what social inequality is that is shared by the various contributors. Social inequality means different things to different people. This dissensus is a result of the theoretical openness that underpins this volume. Given the current lack of a unified body of theory in the field of social inequality, to focus on a single approach would be intellectually factious. Whilst acknowledging this, I do find useful the definition provided by Roscoe (this volume), who essentially defines social inequality in foraging societies as differentials in power relations and status hierarchies acting in tandem to generate various levels and manifestations of social inequality. As Roscoe has discussed, social power 'is something that people continuously contest, drawing on the various capitals at their disposal' in order 'to induce, coerce, or otherwise motivate the behaviour of others' (p. 22). Status differentials emerge 'as a widespread solution to the problem of managing conflicts of interest that arise within and among coalitions and alliances', and thus 'facilitate the formation of large physical aggregations, communities and alliances' (p. 21). Status differentials, as the foundation for social power, can be broken down into dominance and prestige hierarchies, where dominance is the 'ability to win dyadic agonistic interactions' by the use of threat or force, 'with outcomes determining priority of access to resources or mating', in contrast to prestige which denotes 'influence or deference that is freely granted' (Smith et al. 2016: 56). Although both dominance and prestige can be present simultaneously within the same society, prestige competition is the more common pathway to power in non-state societies (Mattison et al. 2016).

By addressing the question of how prehistoric and extant foraging societies shape(d) inequality, I do not dwell on the assumption that 'there was a time before complexity emerged; a time, therefore, of universal simplicity' (Rowley-Conwy 2001: 44). Rather, I argue that the lifeways of hunter-gatherers pose a crucial intellectual challenge to find meaningful ways of using archaeological and ethnographic data to address variability and change in a major social-level phenomenon that holds relevance for current debates in evolutionary social science as a whole, as well as for contemporary communities. Like Kelly (2013: 242), I deliberately eschew the term 'social complexity' (Price & Brown 1985; Keeley 1988), as it directs our attention away from social inequality and leads to an oversimplifying dualistic model of residentially mobile, 'generalized/simple' as opposed to relatively sedentary, 'complex' hunter-gatherers, which masks the subtle variability of hunter-gatherer social organization and dynamic social processes (Burch & Ellanna 1994; Prentiss & Kuijt 2004). Furthermore, 'social complexity' is conceptually biased towards foraging societies associated with resource abundance, especially aquatic resources, and it entails corollary implications of economic and technological complexity (i.e. specialization of tasks and functions) (see also Jeffery & Lahr, this volume). Here I favour the egalitarian/non-egalitarian distinction, conceived as conceptual ends of a spectrum, in the context of variously negotiated or enforced cultural norms or ethoses of individual autonomy (see below).

Material, embodied, and relational wealth

Comparative evolutionary anthropology has recently expanded our understanding of social inequality in foraging societies by emphasizing the differing importance of three interdependent classes of wealth – material, embodied, and relational – and differences in the cross-generational transmission of these wealth classes according to the subsistence mode in which the transfer takes place (Borgerhoff Mulder et al. 2009; Borgerhoff Mulder & Beheim 2011; Smith et al. 2010a,b). Material wealth typically comprises land and household or private assets owned either personally or collectively, by a household or kin group. Drawing on embodied capital theory (Kaplan et al. 2003), embodied wealth encompasses health, body size, strength, cognitive ability (i.e. skill and productive knowledge), all of which variably affect basic fitness with regard to mortality and fertility rates. Relational wealth refers essentially to a person's centrality in a social network, including the number of connections on which an individual can draw based on his social position, trust, reputation, kinship and symbolic goods. Given the primary constraint of residential mobility on material wealth accumulation and transmission, embodied and relational wealth are most important to individual well-being and reproductive success among low density hunter-gatherers (Borgerhoff Mulder et al. 2009; Borgerhoff Mulder & Beheim 2011; Smith et al. 2010a).

The simple correlation of forms of wealth inequality with status and power differentials is currently not practicable. In particular, it would be premature to assume that wealth differentials correlate so firmly with power differentials that to study one is to study the other (Smith et al. 2018). A way forward might require further attention to the properties of different forms of 'capital' underpinning power relations and status hierarchies (Roscoe, this volume) from multiple foraging societies by using comparable empirical measures. Comparable to wealth classes, it is likely that capital classes (i.e. economic, social, symbolic, martial, and so on) to which individual agents have access contribute to the variety of historical trajectories and social forms in foraging societies.

Non-egalitarian hunter-gatherers

Archaeologists interested in the formation of social inequality have often focused on non-egalitarian hunter-gatherers with complex sociocultural institutions (Arnold 1996; Buela, this volume; Fitzhugh 2003, this volume; Fry et al., this volume; Hayden 1994, 1995, this volume; Jeffery & Lahr, this volume; Kelly 2013; Prentiss & Kuijt 2004; Prentiss et al. 2014, 2018a,b; Price & Brown 1985; Roscoe 2006, this volume). These groups are marked (among others) by sedentism or substantially restricted residential mobility, high population densities, ownership and defence of critical resources, moderate to heavy reliance on stored foods, hierarchical sociopolitical organization, inherited status, manipulation of labour through the creation of social obligations of debt, high levels of interpersonal competition and intergroup conflict (including war), ritual feasting, and prestige goods or money-like currencies. So-called 'complex', 'transegalitarian' (*sensu* Hayden 1995), hereinafter 'non-egalitarian' (*sensu* Kelly 2013: 242) hunter-gatherers exhibit numerous features associated with the emergence of so-called *persistent institutionalized inequality* (PII) defined as 'differential access to power or resources involving institutionalization of status hierarchies by hereditary privileges or positions such as social classes, castes, hereditary titles, or heritable differences in wealth' (Mattison et al. 2016: 185). Culturally codified institutional inequalities are embedded in multi-generational practices, in contrast with inequality due to individually achieved inequality in status, power or wealth. The latter does not become normalized in social structures and does not persist inter-generationally, hence is more easily reversable (Fitzhugh, this volume).

Generalizations about wealth inequality differ greatly depending on whether one focuses on more mobile low-density foragers or on the smaller set of sedentary, high-density extant foragers with intergenerational wealth transmission (Smith et al. 2010a: 22). However, the hereditary character of inequality is generally seen as a necessary condition to archaeologically operationalize the concept of inequality and account for spatiotemporal patterns. This is based on the premise that archaeological contexts are always more or less time-averaged. PII is considered to be present when there is archaeological evidence for transmission of material wealth (Prentiss et al. 2018a), with classic examples often drawn from non-egalitarian hunter-gatherers in the Pacific Northwest and western Arctic. It is worth noting, however, that whilst all societies of non-egalitarian hunter-gatherers in those regions had wealth acquisition, they were not all characterized by hereditary (i.e. ascribed) status differences (Buela, this volume; Prentiss & Kuijt 2004). For some scholars, non-egalitarian hunter-gatherers are societies where leadership and status are inherited and leaders have control over non-kin labour (Arnold 1996; Buela, this volume; Fitzhugh 2003, this volume; Roscoe 2006, this volume). For others, social inequality emerges under the combined conditions of resource abundance, technological change, and self-driven 'aggrandizers' engaging in surplus accumulation, competitive feasting, and patronage, without necessarily requiring inheritance of status and leadership position (Hayden 1994, 1995, this volume).

Emergence of inequality

While the inheritance of wealth might maintain inequality once it is formed, inter-generational wealth transfer might just be part of the process whereby social inequality becomes culturally codified and not necessarily a causal factor in understanding the emergence of social inequality (Kelly 2010). Incipient inequality may be produced by a variety of localized processes, and even though the mechanisms of this transition remain poorly understood, its emergence may hinge on questions such as why the collective action, religious beliefs and/or the ecological constraints that prevent material wealth-based inequality from taking place lost its/their effectiveness (Aldenderfer 2010; Fitzhugh 2003, this volume; Kelly 2010, 2013: 248 ff.; Layton, this volume; Mattison et al. 2016; Schulting et al., this volume).

Did the development of inequality involve gradual (scalar) change, or did it jump rapidly from egalitarian to non-egalitarian norms or ethoses? The answer to this question hinges upon how social inequality is defined and how it is achieved (see section 'Modelling Inequality' below). In particular, it depends on whether the emergence of inequality is conceptualized as a continuum of accumulating features or as a threshold that is crossed (Fitzhugh 2003, this volume; Fry et al., this volume; Keeley 1988; Layton, this volume). Fitzhugh has demonstrably argued that the development of intra-community social inequalities in Alaskan Kodiak communities involved more or less gradual change, as they emerged through the confluence of ecological patchiness, defensible resources and social competition, under sufficiently dense populations (Fitzhugh 2003; this volume; Layton, this volume).

Egalitarian by default

Egalitarian hunter-gatherers are typically characterized by an ethos of individual autonomy according to which 'each person has the potential to achieve prestige and where the enforcement of cultural norms prevent a person from using that prestige to gain power over another' (Kelly 2013: 243–4; see also Dyble et al. 2015; Lee 1990; Woodburn 1982, 2005). However, it is worth noting that egalitarianism can mask hierarchy (Flanagan 1989; Kelly 2013: 244). In egalitarian societies, inequalities of status, rank and prestige within gender and age classes are considered to be achieved during an individual's lifetime (hence are relatively ephemeral), not ascribed through inheritance from parents to offspring (Mattison et al. 2016).

Archaeologists have tended to treat all mobile hunter-gatherer societies for whom features of inequality are not evident as simply 'egalitarian' (Hayden 1994, 1995; Ames 2007, 2010a; Pettitt, this volume; Grove, this volume). The absence of evidence for permanent inequality thus becomes evidence for egalitarianism. However, egalitarianism is not what is left in the absence of ranking/stratification; it is a social institution in its own right. It is an active strategy which entails costs and requires active maintenance through levelling mechanisms, therefore it should be studied on the same plane as inequality (Boehm 1993, 1999; Fitzhugh, this volume; Flanagan 1989; Kelly 2013: 244; Knight & Lewis 2017; Layton, this volume; Lee 1990; Reckin et al., this volume; Roscoe, this volume; Stibbard-Hawkes, this volume; Wiessner 2005). Although I assume here that levelling mechanisms were ubiquitous prehistorically, archaeologists would be well advised to eschew the use of thinly veiled ethnographic analogies, as these might become self-imposing and hard to resist once certain patterns are observed.

Archaeologists striving to address variability in the pattern and process of social inequality in past foraging societies should remain wary of assuming that today's hunter-gatherers behave like ancient humans (Kelly 2013: 269–75). In fact, we should not assume prehistoric foraging societies were egalitarian to begin with, as 'there is likely to be little validity to the assumption of ancestral egalitarianism' (Boehm 1999; Grove, this volume, p. 167). Furthermore, many extant hunter-gatherers have disturbed social systems as a result of contact with modern civilization or neighbouring subsistence farmers (Layton 2001; Kelly 2013: 15 ff.), or other influences potentially back to early agriculture, to the extent that the extreme egalitarian ethos of most hunter-gatherer societies today might be due to a breakdown in more formal structures and cultural rules (P. Wiessner, pers. comm). As a case in point, the exchange between Ju/'hoansi and surrounding agropastoralist populations saw the emergence of a series of different relationships such as barter which, contrary to *hxaro* long-term partnerships, 'did not compel relationships of long duration or dominance/submission but rather immediate, balanced reciprocity' (Wiessner 1994: 118). While Ju/'hoansi may have had relatively short-term barter relationships with cultivators, it is worth bearing in mind that other populations of egalitarian hunter-gatherers, such as the Congolese Aka and BaYaka and the Malaysian Batek, had longer-term exchange relationships with cultivators which may have led to profound alterations in their hunter-gatherer livelihoods (e.g. Endicott & Endicott 2008; Headland & Reid 1989; Kelly 2013).

Inequality and egalitarianism are part of a conceptual continuum, to the extent that some scholars conceive them as 'coexisting modalities of a single system' in which the social organization could be fluid (and under constant negotiation) over the course of the annual subsistence round depending on the social agenda of the group (Flanagan 1989: 261; Honoré, this volume; Pettitt, this volume; Wengrow & Graeber 2015). To investigate the evolutionary forces and selective conditions that led to the emergence of egalitarianism in foraging societies, we have to change the null hypothesis according to which egalitarianism is the default form of human social organization in the absence of evidence for permanent inequality. Rejecting inequality in the model does not necessarily imply egalitarianism. There should be a number of intermediate hypotheses to be tested, not just a dichotomy between two extremes.

Measuring inequality, archaeological proxies and theory building

Explanations of the social processes and changing patterns shaping social inequalities in foraging societies are diverse and no unified theoretical framework yet exists (Fitzhugh 2000; Henrich & Boyd 2008; Mattison et al. 2016). A large number of contributions in this volume explore the adaptive tradeoffs of individual strategies to allow for the evolution of inequality within a socioecological framework. These use concepts derived from Darwinian evolutionary theory, especially human behavioural ecology and sociobiology (Buela, this volume; Dyble, this volume; Fitzhugh, this volume; Grove, this volume; Jeffery & Lahr, this volume; Layton, this volume; Reckin et al., this volume; Roscoe, this volume; Stibbard-Hawkes, this volume). Other approaches encompass social ecology (Pettitt, this volume) and historical materialism (Darmangeat, this volume; see also Layton, this volume). All authors attempt to outline context-specific variability or explanations for the variety and complexity of trajectories and social forms of social inequality in relation to environmental, technological or socio-demographic constraints. Although this volume could never hope to be exhaustive, the multidisciplinary scope and multiplicity of approaches represented here lends itself to hypothesis development and testing elsewhere.

The quantitative measurement of cross-cultural inequality across time and space based on the uneven distribution of material wealth is a new direction of research in archaeology (Kohler & Smith 2018). One example is the comparative analysis of the level of socioeconomic wealth inequality among very different societies based on the record of house-size distributions using a common metric, the Gini coefficient. This has not only uncovered unexpected wealth disparities between Eurasia and North America and Mesoamerica in Neolithic and post-Neolithic contexts (Kohler et al. 2017), but it has also expanded our understanding of the material conditions favouring the development of wealth-based inequality in complex fisher-forager societies (Prentiss et al. 2018b). Most chapters in this volume provide empirical content with considerations of subsistence ecology, demography, mobility, social networks, technology, children's enculturation, ritual practice, rock art, dogs, warfare, lethal weaponry, and mortuary behaviour. Nonetheless, the emphasis is less on quantifying degrees of inequality, as done statistically by Kohler & Smith (2018), and more on conceptual concerns. In addition, it is worth noting that in terminal Pleistocene and early Holocene hunter-gatherer societies, embodied and relational wealth are likely to be the dominant forms of wealth, primarily on account of mobility constraints on accumulating and transmitting material wealth-based inequality. However, translating archaeological correlates of embodied and relational wealth into meaningful and measurable units of analysis presents a significant challenge to comparing social inequality between different periods and geographical areas.

Modelling inequality

Recent archaeological simulations have led to theoretical advances in exploring combinations of socio-ecological variables derived from behavioural ecology (e.g. economic defensibility, territoriality, productivity of resource patches, resource predictability, group formation, and competition) influencing the development of inequality in foraging societies under variable demographic and food production conditions (e.g. Hooper et al. 2018; Puleston & Tuljapurkar 2008; Rogers et al. 2011; Smith & Choi 2007). In the modelling literature on inequality, most models focus on theory building as they tend to be at the abstract end of abstract-generalist forms of simulations. Rather than recreating the full complexity of reality itself, the models tend to be very abstract and are often non- (or only marginally) archaeological. The emphasis is on the modelling of a few general processes, yet the scope of implications is very broad (Costopoulos 2015), aiming to 'establish clear principles that sharpen our understanding of real-world phenomena' (Hooper et al. 2018: 109). While they share a common emphasis on 'emergence' at the level of the population, archaeological simulations of social inequality vary in approaches and scale, and overall these lack a unified body of theory – there is no agreement on the assumptions of the underlying behaviour. In addition, the predictions derived from the simulation models are qualitative in nature, hence not easily testable archaeologically.

In order to be able to compare the models against some form of reality, the use of archaeological data is key. Without these data, we cannot directly compare the models with each other or refine possible variable ranges. Generating predictions that can be tested against some form of archaeological reality requires identifying meaningful proxies in the archaeological record to begin with. Using a set of assumptions derived from Malthusian demographic models, Prentiss and colleagues have successfully used a combination of archaeological proxies to demonstrate that the emergence of material wealth-based inequality in hunter-gatherer-fisher communities in the late Holocene Middle Fraser Canyon of British Columbia best corresponds to a byproduct of competitive conditions associated with population and resource imbalances (Prentiss et al. 2014, 2018a). To investigate the impacts of demographic growth on the emergence of social inequality at the interhousehold level, the authors use cache pit volume and fire-cracked rock density as effective measures of variability in household demographic packing. Moreover, the zooarchaeological record of large cache pits within winter house floors is used to assess variable storage practices, resource productivity and food harvest, as well as dog husbandry. House area *per se* was not necessarily indicative of social status in the Bridge River village (Prentiss et al. 2018b).

As this demonstrates, to recognize meaningful archaeological correlates in relation to various forms and levels of inequality, archaeologists need to bear in mind the theoretically and methodologically challenging issues of *multifinality* (i.e. the same level of social inequality might be expressed in entirely different archaeological patterns) and *equifinality* (i.e. different levels of inequality might be reflected in similar patterns). Localized studies and a tight control of local temporal sequences are our best hope of reducing and disentangling the effects of multi- and equifinality (see below; Davies, this volume; Fitzhugh, this volume; Fry et al., this volume).

Status, power and wealth inequalities: achieved or ascribed?

Without assuming the causal factors leading to their emergence, the issue of whether in non-agricultural societies, inequalities in status, power and wealth are achieved or based on ascribed roles through inheritance can be framed by taking a life-course approach. It comes down to the question of whether individual inequality is there at birth, through gender or lineage inequality, or whether it arises over a lifetime, including through the individual's own agency. In most (but not all) foraging societies, status and power differentials are largely achieved (Kelly 2013). To generalize (whilst accepting this encompasses a considerable range of cultural variation), in most Aboriginal Australian and New Guinean groups there are hardly any ascribed roles, yet these societies are far from being strictly egalitarian (e.g. Gardner 1990; Hiatt 1986; Roscoe 2000; Wiessner & Tumu 1998). Taking 'Big men' or West Mianmin 'kamok' (i.e. leader) in New Guinea as an example, there was nothing about them at birth – other than being male – which assigned them big man or kamok status; they have to exert themselves to gain and maintain big-man status (Gardner 1990; Roscoe 2000; Wiessner & Tumu 1998).

As far as intergenerational wealth transfer is concerned, it is worth differentiating between material, embodied, and relational wealth classes (Borgerhoff Mulder et al. 2009). Whilst material wealth is most important for individual fitness and household well-being in pastoralist and small-scale agricultural societies, embodied and relational forms of wealth are predominant across foragers, forager-cultivators and horticulturalists (Borgerhoff Mulder et al. 2009; Gardner 1990; Gurven et al. 2010; Smith et al. 2010a,b,c). All forms of wealth may be heritable. However, embodied and relational wealth are associated with only moderate degrees of inequality and are less conducive to supporting institutionalized social inequality (i.e. PII) than material wealth, mainly because costs of defending the latter are more readily outweighed by returns in reproductive success or household well-being (Borgerhoff Mulder et al. 2009; Mattison et al. 2016).

Relational wealth can be considered to be of particular importance to fitness in foraging societies 'where networks of allies are key to obtaining access to key resources' and pooling risk, and where material wealth is not reliably transmitted to the next generation (Borgerhoff Mulder & Beheim 2011: 354; Gardner 1990; Wiessner 1994). According to Smith and colleagues, the transmissibility of relational wealth 'will depend entirely on the type of network involved' (Smith et al. 2010b: 86). The more 'open' the social network in terms of options for a politically gifted agent to generate a large network of allies beyond that of one's parents, the less likely it is that relational wealth will be transmitted across generations. The moderate intergenerational transmission for relational wealth among 'egalitarian' hunter-gatherers is nonetheless worth noting, as illustrated by the Ju/'hoansi where 'approximately 25% of *hxaro* partnerships were passed from parents to children as parents aged or upon their deaths' (Smith et al. 2010a: 29; Wiessner 1986, 1994).

There is some inherited relational wealth among populations in traditional Australia (e.g. Yolngu) and New Guinea (e.g. West Mianmin) in the sense that a man is born into a genealogical position that may or may not assist his chances of making a particular marriage (Gardner 1990; Keen 1982; Hiatt 1986, 1996). However, leader status is not simply ascribed by any hereditary principle, nor does it pass down the generations of a lineage in a simple or enduring way. In the Australian case, a man's strong or weak genealogical position is not necessarily inherited from his father, or any other particular forebear, because of the particular features of the kinship system (Keen 1982). Rather than any simply inherited inequality, it is demographic contingency that will give a man a better or worse start in the quest for a spouse. This depends on a combination of 'genealogical good luck' (based on sex ratios of past and present sibling sets, and the hazards of premature mortality), enterprise and energy (Hiatt 1986: 13), as well as, at least in the case of the West Mianmin, disruptions of social life through disease or retaliatory raids (Gardner 1990). Importantly, among the West Mianmin where all bonds between individuals are interpersonal, 'genealogical connections provide neither necessary nor sufficient grounds for the existence of close interpersonal relations', thus constraining a leader's position 'within the limits imposed upon all individuals' (Gardner 1990: 13).

Distinct kinds of inequality need to be recognized first and measured separately before their relationship can be properly investigated (Drennan et al. 2010; Peterson & Drennan 2018). Particularly, the degree to which distinct wealth classes interact with each other in generating fitness outcomes and various levels of inequality across populations remains to be fully understood (Borgerhoff Mulder & Beheim 2011; Mattison et al. 2016). Nonetheless, there are good reasons to believe that embodied and relational wealth interact (Ames 2010b), since relational wealth may be an important determinant of individual fitness and fertility inheritance among hunter-gatherers who do not rely on material wealth accumulation and transmission (Chaudhary et al. 2016). Among central African Aka foragers, male leaders are taller than the average male (Hewlett 1988). Moreover, among the Efe, Aka and Mbuti, men's better dental health compared to women's has been hypothetically correlated with greater relational wealth in the form of a larger kin network, providing lifelong access to a relatively greater range of foods, including meat (Walker & Hewlett 1990; Hewlett & Walker 1991). In New Guinea, West Mianmin leaders tend to be about 10 per cent heavier on average than their fellows, and the sons of leaders may be at an informal but pragmatic advantage in becoming leaders themselves. However these objective characteristics are by no means sufficient for becoming a leader (Gardner 1990). Recent investigations among the BaYaka seem to support a pattern whereby individuals with more relational wealth have a significantly 'larger pool of food donors to insure against nutritional shortfalls', and they benefit from higher fitness outcomes in terms of health and reproductive success rates (Chaudhary et al. 2016: 4).

Pending additional data on the ecological and social context of relational and embodied wealth in extant forager societies, the degree of intergenerational transmission for these wealth classes and their contribution in fostering gender inequalities and a competitive ethos among children, needs to be further explored (Borgerhoff Mulder et al. 2019; Kelly 2013: 266; Reckin et al., this volume; Smith et al. 2010a,b). According to Kelly (2013: 239), the 'division of labor may lay a foundation of inequality between men and women in perceived status'. In fact, in most hunter-gatherer societies status, power and wealth differentials with regard to individual scope for personal autonomy are not ascribed, other than relative to gender, particularly when it comes to politics of marriage where opportunities are generally not equal. As a case in point, in most of traditional Australian Aboriginal society, life chances at birth are differentiated by gender, specifically with regard to the freedom of choice in marriage (Gale 1978; Goodale 1971; Keen 1982; Hiatt 1986; Maddock 1972). In most places, men also play the dominant role in religion and ceremony and women are sometimes excluded, although 'individual women display leadership and initiative in the organization and performance of women's secret ceremonies' (Hiatt 1986: 15).

The degree of intergenerational transmission of relational and embodied wealth in pre-Holocene foraging societies for which there is no uncontested evidence of institutionalized social inequality remains an open issue. However, it is worth bearing in mind that 'our present-day assumptions about hunter-gatherers are based on a narrow range of behavioural variation available to us in the ethnographic record', and accordingly 'archaeological research adds to our knowledge of the range of hunter-gatherer behaviors. These additions need not, and will not, only mirror what is already known; they will offer us examples of the unknown' (Soffer 1985: 489–90). If we assume that embodied and relational wealth were the dominant forms of wealth during the terminal Pleistocene under its high frequency, high-amplitude climate fluctuations and resulting resource instability, it is crucial to develop meaningful indices in order to identify patterns and reconstruct processes through time and space. A way forward could be to build a database of biological features, such as skeletal pathologies and indicators of disease, stature, effects of workloads, dental health and dietary differences based stable isotope data. This would allow researchers to investigate potential health and dietary consequences of social inequality and their differential distribution within groups of women or men of different age groups, as well as among and between prehistoric forager groups (Davies, this volume; Schulting et al., this volume).

Evidence of inequality predates the Holocene

The suggestion that there were differentials of social status, power and wealth in the terminal Pleistocene is considered a radical interpretation by many. It therefore seems crucial to ask whether this suggestion implies that these differentials were transmitted intergenerationally or not, and whether gender differentials are intended to be included in the scope of analysis. Putting forward a series of Upper Palaeolithic innovations such as rich burials, personal ornaments, dog husbandry and rock art, several of the chapters in this volume suggest that the term 'egalitarian' does not effectively capture the degree of social differentiation and inequality that existed in terminal Pleistocene Europe (Germonpré, this volume; Guy, this volume; Hayden, this volume; Pettitt, this volume). Others suggest that socio-economic inequalities typically associated with non-egalitarian foraging societies, especially those of North America's Pacific Northwest region, would have been difficult to sustain under the environmental and demographic conditions characterizing Upper Palaeolithic societies (Davies, this volume). Of course, no society is perfectly egalitarian, but not all are highly structured systems for ownership of resources and social prerogatives built upon hereditary claims to titles and territories.

If there was more social inequality than meets the eye among Upper Palaeolithic societies of Europe, it was in a way that is dramatically different from middle and late Holocene non-egalitarian foraging societies. Notwithstanding the preservation issue of Upper Palaeolithic sites that have been drowned by rising sea levels, the lack of archaeological visibility is not a satisfying explanation to account for the absence of clear evidence for structural inequality (PII) in terminal Pleistocene Europe despite more than 150 years of archaeological research. Rather, the main explanation might lie somewhere else: that relational and embodied wealth, rather (or less so) than material wealth, were the dominant forms of wealth differentials which structured social relations in life and upon which social inequality was built in the European Upper Palaeolithic. This is especially so given the constraints of residential mobility on material wealth accumulation and transmission. Upper Palaeolithic burials, personal ornaments, dog husbandry and rock art were all part of a cultural system characterized by an unprecedented richness in symbolic expression, where embodied and relational wealth were likely most important to individual well-being and reproductive success. To assess differentials in status, power and wealth of Upper Palaeolithic societies through the lifeways of non-egalitarian hunter-gatherers characterized primarily by high levels of material wealth-based inequality (PII) is accordingly of only limited heuristic utility as it falls short of accounting for the fact that there is little evidence of material wealth before the Holocene to begin with.

Rich burials, personal ornaments, dog husbandry and rock art

The continent-wide burial tradition and associated funerary behaviour that emerged among *Homo sapiens* populations in the course of the European Upper Palaeolithic denotes a symbolic behaviour of unprecedented ritual elaboration (Pettitt 2010). Particularly, the richly furnished primary burials associated with prestige goods and elaborate structures have often been used to call into question the supposedly egalitarian character of Upper Palaeolithic hunter-gatherers, and instead to advocate for a view of Upper Palaeolithic lifeways more consistent with accounts of extant material wealth-based non-egalitarian hunter-gatherers (d'Errico & Vanhaeren 2015; Guy 2017, this volume; Hayden 2018, this volume; Vanhaeren & d'Errico 2005). Based on the premise that in foraging societies, the construction of durable mortuary structures is often reserved for privileged individuals, and that grave goods may inform about the degree of social inequality of a given society (Testart 2006, referenced in d'Errico & Vanhaeren 2015), the following arguments have been put forward. First, the presence of prestige items among the grave goods of Upper Palaeolithic burials contrast with those burials without grave goods (or with goods of lesser prestige) and with the types of personal ornaments from contemporary habitation floors. Prestige goods are regarded as items made of rare materials, requiring time-consuming manufacture, potentially involving elaborate techniques, and as such represent a tangible expression of a privileged social group. Second, the abandonment of prestige items in burials indicates their status as money-like currencies as 'part of a strategy of deliberately removing wealth from the exchange network, which prevents the gradual loss of their value' (d'Errico & Vanhaeren 2015: 50).

Clearly, the evidence of status differentiations beyond those based on age, gender, or skill, as testified by the rich Upper Palaeolithic burials, has no modern analogue in groups committed to maintaining an ethic of egalitarianism. Notwithstanding the stringency of adopting a contextualized comparative analysis of grave goods and contemporary personal ornaments found at habitation sites to identify prestige goods, it is debatable whether we can interpret prestigious grave goods as money-like currencies in the Upper Palaeolithic, or understand the implications in terms of material wealth-based structural inequality. The interpretation falls short of offering the most parsimonious explanation, namely that Upper Palaeolithic status, in the form of prestige, is a type of symbolic capital (Roscoe, this volume), hence an expression of relational wealth.

The common and widespread presence of personal ornaments in the archaeological record testifies to the importance of relational wealth in Upper Palaeolithic hunter-gatherer communities in Europe. In addition to their aesthetic value, personal ornaments represent the material (visual) expression of an exclusively symbolic communication signalling identity, social position, as well as intra-group and inter-regional social connections on which individuals can draw (Bar-Yosef Mayer & Bosch 2019; Vanhaeren & d'Errico 2005, 2006; Whallon 2006). Given their non-utilitarian character and non-random redundancy in form across time and space, personal ornaments represent suitable proxies for the cultural geography of Upper Palaeolithic societies, with the use and variable association of distinct standardized bead types possibly reflecting ethno-linguistic diversity (Vanhaeren & d'Errico 2006). Clearly, the use of standardized beads over broad geographical areas starting in the early Upper Palaeolithic corresponds to an expansion in the scale and frequency of human social interaction beyond familiar individuals (Gamble 1999). This may possibly correspond with increases in population densities relative to available territories (compared to earlier periods), which brought about a broadening of human diets, as well as heightened levels of competition within or between human societies (Kuhn & Stiner 2007). The degree to which relational wealth was actually transmitted vertically from parent to child in Upper Palaeolithic societies remains an open question. However, the geographical patterning and formal continuity of distinct types of personal ornaments across time in relation to time-averaged cultural traditions (Kuhn & Stiner 2007; Newell et al. 1990; Vanhaeren & d'Errico 2006) strongly suggests at least some form of long-term reproduction of broad networks of reciprocity, where reciprocal relations within generations are being inherited by successive generations, similar to the long-term *hxaro* partnerships among the Ju/'hoansi (Wiessner 1994).

Under terminal Pleistocene conditions with seasonal, not particularly abundant or predictable resources, dog husbandry is likely to have been costly (Germonpré et al., this volume). However, if they played an active part in increasing hunting success, talented dogs are likely to have increased the relational and embodied wealth of their Upper Palaeolithic owners in terms of prestige, social status, and biological fitness outcomes (Germonpré et al., this volume; Gurven & von Rueden 2006). Among ethnographically documented hunter-gatherers, there is often no clear division between the economic sphere and those of ritual and power (Hayden 2018, this volume; Schulting et al., this volume). Considering the significant part dogs play in rituals in extant foraging societies, ritual knowledge concerning dogs might thus have influenced the owner's centrality in the social network of his community, thus fostering asymmetries in access to social connections and possibly critical resources, such as mates or food (Germonpré et al., this volume).

Upper Palaeolithic rock art might have played a powerful role in the shared process of negotiation and perpetuation of social norms through repetitive acts (Guy, this volume; Honoré, this volume; Pettitt, this volume). Moreover, rock art, particularly cave art, formed part of a range of activities that derived from some kind of supernatural or religious context (Gittins & Pettitt 2017). Thus religion is likely to be part of the causal mix of factors that led to the emergence and maintenance of, as well as resistance to, attempts to create persistent social inequality in the past (Aldenderfer 2010). Despite non-negligible methodological challenges, the social analysis of rock art contributes to crafting more plausible interpretations of the emergence and negotiation of social inequality in the context of belief systems and practices that were key elements of the lives of past foraging societies.

Tight control of local temporal sequences is essential

The majority of archaeological examples of hierarchical hunter-gatherer societies characterized by institutionalized inequality (PII) are found in the middle and late Holocene (Ames 2007; Fitzhugh, this volume; Flannery & Marcus 2012; Fry et al., this volume; Kelly 2013). However, using the middle to late Holocene PII as a starting point from which to address prior variability in social patterns and processes is questionable. This is especially so given that status and power differentials in Upper Palaeolithic foraging societies are likely to have been associated with relational and embodied wealth, not material wealth accumulation and transmission. Moreover, by opposing one single egalitarian 'Palaeolithic reality' to the unequal 'post-Pleistocene reality', we tend to overlook variability in social behaviour despite remarkable differences among Upper Palaeolithic societies associated with distinct periods and cultural traditions. Davies (this volume) makes the case that mobility, technology, subsistence, and mortuary treatment varied greatly within and between the major Upper Palaeolithic traditions. The dissimilarities in demographic and ecological histories within the Palaeolithic are so great that unless we begin to address the millennial evolution of local histories and with it, the negotiation of social life, we are never going to understand its diversity.

One of the major challenges for archaeologists in devising tests of hypotheses concerning inequality is having sufficient resolution in the record to adequately explore the nuances of model predictions (Prentiss et al. 2018a). The contributions in this volume encourage detailed contextual research and care when using simple ethnographic analogies. In addition to the awareness that the kind of inequality we are looking for in the archaeological record is not necessarily material wealth-based, tight control of local temporal sequences is essential to recognize variation and to be able to address both functional and historical levels of explanation. This is necessary for outlining the diachronic emergence or evolution of some behaviour or strategy, as well as explaining the adaptive benefits an agent gains from it (Codding & Jones 2010). Moreover, it may be that occurrences of inequality were highly constrained. We need to conceive of inequality (in whatever form) as a potentially short-lived by-product of local demographic, environmental and technological conditions, and prevailing social rules. The reasons why egalitarian norms fell apart and new norms developed to support asymmetric social relations (or the other way around) have to be addressed at the regional scale. If Pleistocene climates were as unstable as inferred, then no single pattern of social organization would have been very long-lived (Ames 2010a). As a result, to draw firm conclusions about the meaning of 'prestigious' burials with regard to the social organization of Upper Palaeolithic populations *as a whole* is premature at best. At worst, it is an oversimplification of the evidence at hand considering the small total sample of (dated) Upper Palaeolithic primary burials given the vast area and time span under consideration (Pettitt 2010). More detailed, localized studies are also our best hope of reducing the effects of equifinality and multifinality, given that outcomes and traits can have several explanations.

Some models of inequality emphasize storage as a primary cause of wealth accumulation and status competition (Testart 1982). Bearing in mind the drowning of terminal Pleistocene coastal sites by rising sea levels, the absence of clear evidence for surplus production and seasonal food storage in the Upper Palaeolithic is nevertheless worth noting (Péan 2015; *contra* Soffer 1989). While this gives credit to the idea that storage economies did not exist among Upper Palaeolithic groups living in continental inland environments (Testart 1982), surplus production and storage cannot possibly be invoked to explain the development of incipient inequality in foraging societies prior to the Holocene. However, elements of territoriality, reduced mobility, economic intensification, ritual elaboration, and demographic increase have all been variably recognized in the Upper Palaeolithic record of Europe and, without assuming their congruence, used as proxy measures for social change (Davies, this volume; Gamble 1999; Germonpré et al., this volume; Guy 2017, this volume; Hayden 2018, this volume; Kuhn & Stiner 2007; Pettitt 2010, this volume; Soffer 1985, 1989; Vanhaeren & d'Errico 2006). Based on those elements, it may be tempting to impose normatively framed presumed threshold boundaries on Upper Palaeolithic variability to infer the corollary emergence of incipient inequality in the terminal Pleistocene. However, the heuristic value of threshold models of hunter-gatherer social evolution is questionable, since boundaries should be framed as hypotheses and discovered in the empirical evidence rather than posited upfront (Davies, this volume; Fitzhugh 2003, this volume).

I have tried to make clear that categories such as 'hunter-gatherer', 'small-scale', 'egalitarian' and 'achieved status' are not congruent, but they also overlap. Most foraging groups live at a small scale and low density, but some do not (Kelly 2013: 248 ff.; Roscoe 2000, 2006, this volume). Moreover, most mobile hunter-gatherers live in groups permeated by links between non-relatives, where residential group membership is fluid and embedded in large-scale social networks of relational wealth, possibly inherited from the terminal Pleistocene spread of modern humans (Bird et al. 2019; Dyble, this volume). Equally, many non-hunter-gatherer groups (e.g. cultivators/horticulturalists and pastoralists), also live at relatively small scales (Borgerhoff Mulder et al. 2010; Gurven et al. 2010).

From an archaeological point of view, to treat hunter-gatherer societies for whom features of status, power and wealth are not evident as simply 'egalitarian' is no longer tenable in the light of the aforementioned observations. On the one hand social inequality is practically ubiquitous in certain definable respects, whether achieved, ascribed, gender-related or hinging upon 'genealogical good luck'. On the other hand, in a good number of hunter-gatherer societies there is clearly an ethos of egalitarianism pervading over practical inequalities, either within genders or across agents; however, there are notable exceptions (Kelly 2013). Both of these arguments underscore the theoretical and methodological challenges of addressing the question formulated at the outset of what can be learned from the way foraging societies shape(d) social inequality.

In most but not all hunter-gatherer societies status, power and wealth differentials are largely achieved. Gender roles are generally not what people have in mind when distinguishing achieved/ascribed roles, but if anything, it is probably not going too far to claim that gender roles are ascribed. In fact, given the complementary economic roles for men and women among ethnographically documented hunter-gatherers, it has been hypothesized that the division of labour along the lines of gender did appear in western Eurasia during the terminal Pleistocene with the beginning of the Upper Palaeolithic after 40,000–50,000 years ago (Kelly 2013: 274; Kuhn & Stiner 2006). In any case, it is worth bearing in mind that 'social inequality is inseparable from gender inequality. Therefore, before we consider nonegalitarian sociopolitical organization, we need to consider gender equality' (Kelly 2013: 244).

Perspectives

Much more work is needed on modelling and testing environmental productivity to understand better how social relations in terminal Pleistocene Europe were conditioned by structural differences in access to subsistence resources (Davies, this volume). At the same time, hunter-gatherer social strategies are not just adaptations to specific ecological conditions and resource configurations. The pursuit of wealth, power and prestige has emergent consequences which shape the social and ideological structure of hunter-gatherer society and guide decisions to compete or co-operate

(Fitzhugh 2000, this volume; Layton, this volume). As a matter of fact, the richness in evidence for ritual elaboration and symbolic 'storage' characterizing Upper Palaeolithic societies stands in sharp in contrast to the lack of compelling evidence for material wealth-based socioeconomic inequality. Accordingly, the extent to which Palaeolithic archaeology can contribute to current debates in evolutionary social science on the emergence of social inequality depends on its ability to identify and characterize variation in relevant ways. These must seek common ground between materialist explanations derived from evolutionary ecology, and not materialist 'bottom-up' approaches (DeMarrais & Earle 2017) aiming to explain the ways that asymmetries in access to social networks and ritual knowledge are organized, and how consensus and social cohesion are articulated at a local level. In particular, approaches based on heterarchy might be worth exploring to consider questions of negotiation and perpetuation of social lifeways and structures in allegedly 'egalitarian' Palaeolithic societies. Heterarchy has been defined as 'the relation of elements to one another when they are unranked or when they possess the potential for being ranked in a number of different ways' (Crumley 1995: 3). As such, heterarchy approaches represent 'a direct challenge to neo-evolutionary typologies (and to the assumption that power relations are hierarchical)' (DeMarrais & Earle 2017: 193; Buela, this volume). If analogies for European Upper Palaeolithic foraging societies were to be sought, in order to derive testable hypotheses on the dynamics of social change, the foraging societies of the Russian Far East might be more appropriate than the often referenced hierarchically organized non-egalitarian hunter-gatherers of North America's Pacific Northwest region. These former groups are characterized by a heterarchical social order where power relations are based on systems of values that are ranked and re-ranked as conditions change (Stépanoff 2019). In any case, revisiting the European Palaeolithic record in the light of the approaches and ideas put forward in this volume is all the more relevant since 'integrating the Palaeolithic within a social agenda will also have a considerable impact on how the rest of archaeology is practised' (Gamble 2004: 17).

Structure of the book

This interdisciplinary edited volume gathers together 32 researchers affiliated to various international universities and research centres working in the fields of prehistoric archaeology and cultural and evolutionary anthropology. The book aims to contribute to an ongoing commitment of prehistoric archaeologists to explore variability in the pattern and process of social manifestations of inequality before farming. We believe that this monograph will generate great interest in the international academic community, providing grist for the mill of scholarship and a key reference text for all readers interested in social narratives about life in hunter-gatherer communities.

The papers of the conference cover a variety of topics organized around three major themes, which structure the book: 1) social inequality and egalitarianism in extant hunter-gatherer societies; 2) social inequality in Upper Palaeolithic Europe (*c.* 45,000–11,500 years ago); 3) social inequality in prehistoric Holocene hunter-gatherer-fisher societies globally. In addition to providing new data from multiple contexts through space and time, and exploring social diversity and evolution from novel perspectives (e.g. Pleistocene dogs as an incipient means by which inequality developed in pre-farming societies; the cross-cultural role of children's learning and practice in the transition from egalitarian to non-egalitarian social structures), by developing meaningful questions and answers, the book advances discussions that seek to address the emergence, institutionalization, and persistence of social inequality in past and present non-agricultural societies.

Part 1: Social inequality and egalitarianism in extant hunter-gatherer-fisher societies

In Chapter 1, **Roscoe** offers a thought-provoking explanation for why contact-era New Guinea foragers dependent on terrestrial game had lower levels of power and status inequalities than those reliant on aquatic fauna. His fundamental argument is that population density impacts the potential for inequality to emerge based on the costs of inter-personal networking necessary to establish power differentials over others in small, face-to-face communities. Low density, dispersed, mobile populations characteristic of hunter-foragers make for very high costs of maintaining such networks, while the increased density, nucleation, and sedentism of fisher-foragers provide low-cost situations for building networks and undertaking social negotiations. Roscoe further argues that in New Guinea, status inequalities emerged from a social mechanism aimed at deploying signals of fighting strength, in order to manage conflicts of interest within social alliances and coalitions.

In Chapter 2, **Reckin** and colleagues use a meta-ethnographic approach to explore the role of children in the emergence of inequality in hunter-gatherer contexts. Contrary to the popular agent-centred arguments that assume personalities are genetically programmed and that inequality is thus inevitable with the right resource configurations, Reckin et al. stress the way that children are enculturated is a critical element of understanding the transition from immediate-return, egalitarian foraging lifeways to delayed-return, non-egalitarian lifeways. Underpinning children's learning contexts, changes in mobility and work are important factors in fostering gender inequality and creating a competitive ethos that children carry into adulthood.

In Chapter 3, **Dyble** explores the influence of residential decision-making on the composition of groups, the distribution of kin across space, as well as the potential for cooperation within groups and cultural exchange between groups. Dyble stresses that multilocal post-marital residence, in which individuals and households are highly mobile and where men and women may both leave their natal group to marry, can be considered an important manifestation of equality among egalitarian hunter-gatherers. A move away from multilocality into a more restrictive unilocal system of residence may drive important changes such as the probability of increased inter-group differentiation and reduced co-operation, and consequently may increase the potential for non-egalitarian social structures to form.

In Chapter 4, **Darmangeat** contends that the emergence of wealth differentiation can come with or without stored surpluses of food if material goods as representative of labour investment, so-called 'W' goods, can serve the same purpose. Using a wide range of hunter-gatherer groups which do not all make use of payments in social negotiations, in this thought-piece Darmangeat stresses the weakness of the traditional 'surplus theory' put forward by Alain Testart, and advocates the key role played by the emergence of payments such as bride wealth payments and wergild to explain wealth distinction.

In Chapter 5, **Buela** presents a case study of high-latitude hunter-gatherers of northern Alaska to address issues of leadership and material wealth-based social inequality and their changing dynamics in pre- and post-contact situations, building on ethnohistoric accounts and ethnographic fieldwork. The evolution of inequality is not well understood in the western Arctic. The whaling communities of the Iñupiaq society provide an example of social inequality in the context of high population densities and reduced mobility, in which the ownership of boats and the strong reliance on storage allowed some men to own the means of production and to manipulate labour and garner influence through the establishment of whaling teams. However, the Iñupiat big-man type of leadership was not ascribed and could be ephemeral as communities reacted to perceived quality of leadership and generosity with outcomes of the hunt. Although the *umialik* was always a male, women enjoyed high levels of autonomy – they had considerable control over their sphere of production and could also become shamans. Consequently, men's and women's leadership is, to a large extent, heterarchical rather than hierarchical.

In Chapter 6, **Stibbard-Hawkes** explores why many hunter-gatherers appear relatively egalitarian. He reviews the 'lethal weapons hypothesis' which holds that among hunter-gatherers, democratized individual access to lethal, ranged weapons either promoted the evolutionary development of egalitarianism, or is essential to maintaining it. Stibbard-Hawkes discusses the strengths and limitations of the hypothesis, as well as the difficulties involved in testing it, given incomplete ethnographic and archaeological data. The value of the hypothesis remains ambiguous, given that the evidence at hand to support it is also consistent with alternative hypotheses from socioecology, namely the resource distribution hypotheses. The chapter concludes with some potentially fruitful avenues of research that may provide greater clarity in the future.

In Chapter 7, **Layton** argues for a synthesis of Darwinian and Marxist theories of social evolution in hunter-gatherer communities. He acknowledges that ecological conditions set the stage that will make some social behaviours more prevalent than others. At the same time, social strategies have emergent consequences which shape the political structure of hunter-gatherer society. Through ethnographic examples, Layton discusses to what degree ecology imposes limits on the evolution of social inequality and offers the critical argument that inequality results from a breakdown in reciprocal altruism. In Australia, the relatively unpredictable ecology and the lack of regular (seasonal) surpluses renders sharing and reciprocity more adaptive than hoarding and competition. In North America's Pacific Northwest region, the shift in social organization from reciprocity to competition seems to have happened when it was no longer in people's interests to maintain relationships of reciprocity and co-operation with neighbouring groups (see also Fitzhugh, this volume).

Part 2: Social inequality in Upper Palaeolithic Europe

In Chapter 8, **Hayden** reviews possible archaeological indicators of secret societies in the European Upper Palaeolithic (*c.* 45,000–11,500 years ago) and portrays a more thought-provoking type of social organization than is usually assumed. He observes that Upper Palaeolithic archaeology does not conform to the ethnographic accounts of simple foragers. Instead, Upper Palaeolithic societies, especially those that produced notable art, can be compared to complex hunter-gatherers like those in California and the

American Northwest Plateau. Hayden offers a critical argument that, since ancestor cults and secret societies were relatively common features in ethnographic 'transegalitarian' hunter-gatherer societies, we should expect them to have been common among Upper Palaeolithic complex hunter-gatherers as well. The ethnographic record reveals that the ritual elaboration characterizing secret societies was used by individuals to promote their self-interests and enhance their power and control in communities, hence they were a major means of creating socioeconomic inequalities and social divisions.

In Chapter 9, **Davies** provides a nuanced assessment of spatio-temporal variability in the light of environmental fluctuations in the Upper Palaeolithic. In contradiction to Hayden, Davies shows that the environment of Europe during the Upper Palaeolithic, in terms of both predictability and abundance of food resources, was generally not similar to those environments that are associated with the complex hunter-gatherer societies of North America's Pacific Northwest region. Given the constraining role of ecological conditions in setting the stage for non-egalitarian forms of social organization, it follows that Upper Palaeolithic environments were generally not of the kind that would sustain non-egalitarian hunter-gatherers. Davies further evaluates palaeo-demographic estimates and concludes that socio-economic inequalities were difficult to sustain under the conditions of low population densities which characterize the European Upper Palaeolithic. Although the overall environmental productivity does not support interpretations of social complexity, Davies stresses the ritual elaboration of Upper Palaeolithic groups which indicates strong potentials for inequality, and should encourage archaeologists to consider more nuanced explanations.

In Chapter 10, **Grove** observes that while many studies begin with the unjustified assumption of ancestral egalitarianism, they rarely postulate what the advantages of such egalitarianism would have been. Studies that address the latter issue show that reciprocal altruism and kin selection are behind apparently altruistic acts of co-operation (as they are in all other animals). Using a comparative perspective, Grove stresses that an ancestral state of inequality among humans is the more parsimonious assumption. Behavioural differences among apparently egalitarian foragers in terms of skills, craft specialization, and prestige, all represent potential precursors to the incipient development of social inequalities. Grove's suggested approach moves beyond the idea of (in) equality as a dichotomous variable and instead encourages us to view archaeological attributes produced by specialization as potential markers of incipient status differentials, thus setting the stage for acceptable social inequalities to persist.

In Chapter 11, **Germonpré** and colleagues make the case that Pleistocene dogs might have represented an incipient means by which inequality developed in pre-farming societies. Since dog feeding is costly and competes with human food supply especially in those regions where food availability is seasonal, Germonpré et al. propose that dog husbandry likely provided embodied and relational wealth and fitness benefits to their Upper Palaeolithic owners. Furthermore, given the important role that ethnographic dogs play in rituals, it is possible that ritual knowledge was monopolized and transmitted across generations, thus contributing to persistent social inequalities among Upper Palaeolithic hunter-gatherers. However, dog husbandry during the Upper Palaeolithic would have been possible only during times and at locations when surplus food would be available and/or when the advantage of having dogs would outweigh the costs of keeping them. Intriguingly, Palaeolithic dogs prior to the Last Glacial Maximum are mostly found in sites with a preponderance of mammoth remains and/or with evidence of mammoth hunting.

In Chapter 12, **Pettitt** provides a thematic dimension to existing arguments for social inequality in the Upper Palaeolithic by arguing a case for social stratification in the Lower Magdalenian art of Lascaux. Based on the universal notion among recent hunter-gatherers that animals are both part-human and part-animal, Pettitt suggests the world view and social organization of Upper Palaeolithic societies should be evaluated alongside that of their prey and predator contemporaries. Using multiple lines of evidence, he interprets the prevalence of animal depictions of competition and aggression at Lascaux as an indicator of considerable social negotiation between individuals, which he finds incompatible with the notion of a society that is egalitarian. Reflecting on Dahrendorf's previous discussion concerning the question of whether social differentiation can be equated with social stratification, Pettitt stresses the scale of skill-sets demonstrable in Lascaux's art (and in many other Upper Palaeolithic decorated caves) cannot be taken as indicative solely of an ephemeral set of individual differences that made no contribution to a more pervasive social stratification.

In Chapter 13, **Guy** claims that the naturalism of Upper Palaeolithic figurative art is the product of hierarchical social forces. Based primarily on arguments from art history, Guy contends that art was used to symbolically 'store' individual and group identity and to communicate power relations. Moreover, the high technical level characterizing Upper Palaeolithic figurative art implies some degree of individual specialization as a result of a long apprenticeship. Guy hypothesizes that societies needed to be wealthy enough to economically support specialists during their training and their professional activity, and that artistic specialization is likely to mirror a division of labour and a certain degree of social stratification. Similarities in Upper Palaeolithic style conventions over sometimes considerable distances are thus ascribable to elite marriage and wealth exchanges.

Part 3: Social inequality in prehistoric Holocene hunter-gatherer-fisher societies

In Chapter 14, **Fitzhugh** draws on two case studies of the North Pacific (Kodiak and Kuril archipelagos) to make the case that intra- and inter-community dependence and inequality is impacted by the structure of the ecosystem which creates asymmetries of opportunity and access to critical resources. Fitzhugh explores the evolution of institutionalized inequality in both regions from a human behavioural ecology perspective regarding the extent to which communities could be self-sufficient, and the degree to which family groups could monopolize control over resource patches and leverage surplus into social status. At Kodiak Island, socio-ecological configurations favoured patron-client relationships within the community, whereas the redundancy of productive patches over scales larger than villages held the centralization of multi-village communities into larger polities in check. Conversely, at Kuril Islands Fitzhugh observes the opposite pattern – local egalitarianism because of lower overall productivity and fewer predictable and controllable resource patches, and non-egalitarian interactions at the regional level due to macro-scale differences in resource distributions. The remote islanders were more vulnerable to ecological risk and more willing to serve as clients to their Hokkaido (and possibly Kamchatka) trade partners, which opened trade for obsidian and social support in times of need.

In Chapter 15, **Jeffery** & **Lahr** make the case that the long-standing conceptual association of fisher-forager economies and sociocultural complexity is biased towards fisher-foragers from exceptionally productive and predominantly high (≥40°) latitude marine coastlines. Using a cross-cultural ethnographic sample that includes both low and high latitude populations, Jeffery & Lahr provide a quantitative test of the weak relationship between aquatic resource-dependence and social inequality in lower latitude aquatic environments, which were characterized by lower productivity and thus were unable to support large group sizes. Drawing on archaeological data derived from the African Aqualithic (i.e. low (<40°) latitude fisher-foragers of late Pleistocene and early Holocene Africa who relied primarily on inland freshwater habitats), Jeffery & Lahr further stress the diversity of prehistoric fisher-forager adaptations in low latitudes, contingent on multiple ecological, historical and demographic constraints. Greater complexity in the African Aqualithic appears primarily associated with the incorporation of domesticates into a fisher-forager economy, in contrast to aquatic resource-specialization in more productive higher latitude environments.

In Chapter 16, **Schulting** and colleagues present a plausible case for socioeconomic inequality in Mesolithic Europe through the use of stable carbon and nitrogen isotope analysis at the large Mesolithic cemetery of Zvejnieki, Latvia, used by fisher-hunter-gatherer communities over a period extending over two-and-a-half millennia (*c*. 7000–3500 cal. BC). Schulting et al. observe that, among the burials with grave goods, presence or absence of tooth pendants in death signalled a meaningful divergence in the foodways and hence life histories of individuals. Those interred with pendants had long-term diets that made greater use of lower-trophic-level sources of protein, most plausibly interpreted as a greater reliance on terrestrial rather than aquatic fauna. Based on the observation that at Zvejnieki there is no clear spatial clustering of graves with and without tooth pendants, Schulting et al. favour the interpretation of vertical status differentiation according to a clan-based social organization, rather than a horizontal social division into two distinct communities of ostensibly equal standing. The maintenance of the link between diet and tooth pendants in a similar way over more than two millennia, without leading to more overt status differences, suggests ecological restrictions on intensifying hunting, as well as social levelling mechanisms.

In Chapter 17, **Honoré** explores social differentiation and interaction through the sociological study of group depictions at one of the most important rock art sites of Africa, Wadi Sūra II shelter, in the Egyptian part of the Libyan Desert. Dating back to the Mid-Holocene around 6000 BC, the rock art site of Wadi Sūra II exhibits nearly 8000 paintings, all attributed to the last hunter-gatherers of the Eastern Sahara. Among the analysed 66 group scenes with at least two individuals, there is an apparent co-existence of mythological scenes in which the sameness of individuals stands out, as opposed to individuality expressed more often in subsistence activities. Thus, Honoré questions the epistemological relevance of the dualistic model of egalitarian versus inegalitarian societies. She concludes that inequalities have been expressed more or less strongly depending on the 'social agenda' of the group, rather than codified hierarchical status differences between individuals.

In Chapter 18, **Fry** and colleagues combine ethnographic and archaeological data to address the origins of organized inter-group conflict or warfare in the evolutionary past. Based on a variety of demographic, subsistence, and socio-political variables derived from a cross-cultural sample of 30 extant forager societies, Fry et al. quantitatively test the alleged correlation of warfare with increased sociopolitical complexity, as well as the correlation of warfare with population density versus pressure. They conclude that sociopolitical complexity, as represented primarily by their sample of non-mobile foragers, contributes significantly to rising frequencies of inter-group lethal violence incidences of 'more-than-one perpetrator engaging more-than-one victim'. Likewise, population density strongly correlates with group-on-group lethal violence, whereas population pressure does not. Based on archaeological evidence, and with the possible exception of Jebel Sahaba, they stress that while there is evidence of occasional homicide before the Holocene, warfare developed at different times within the Holocene along with sociopolitical complexity and increasing population density, among both foragers and food producers.

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Part I
Social inequality and egalitarianism in extant hunter-gatherer-fisher societies

Chapter 1

Social inequality among New Guinea forager communities

Paul Roscoe

This chapter deploys ethnographic data on contact-era New Guinea foragers to explain why hunter-gatherer communities that depend primarily on terrestrial game for the faunal component of their diet have markedly lower levels of social inequality than those reliant mostly on aquatic resources. An initial problem in forging this argument is that social inequality means different things to different people: economic inequality, political inequality, social stratification, relative depredation to mention just a few. In this chapter, I focus on inequalities in power and status, the latter an ambiguous term that can mean both dominance and prestige (Henrich & Gil-White 2001: 166–7). Beginning with power, I contend that in small, face-to-face societies the ability of individuals to construct power relations over others is critically mediated by the distribution of population on a landscape – its density, dispersal, and mobility. I then argue that status differentials – understood as both dominance and prestige hierarchies – emerge as a widespread solution to the problem of managing conflicts of interest that arise within and among coalitions and alliances. In small-scale human communities, this solution deploys public generosity and ceremonial activities such as feasting, dancing, and monument construction as honest signals of individual and collective fighting strength that, by establishing dominance and prestige hierarchies, facilitate the formation of large physical aggregations, communities and alliances. In conclusion, I justify my focus on power and status by showing how these foci analytically embrace most if not all of the inequalities researchers have in mind when they think of social inequality.

Although my focus in this chapter is forager communities, the arguments emerged from a database spanning a spectrum of New Guinea's egalitarian, trans-egalitarian, and petty-chiefdom political forms. In principle, therefore, the contentions I advance offer a unified way to think about social inequalities in small-scale society in general.

The foragers of contact-era New Guinea

There is a widely held misconception that New Guinea is a land of horticulturalists. A detailed review of the New Guinea ethnographic record, however, turns up numerous references to 'hunters and gatherers' (Roscoe 2002), and at least ten contact-era groups appear to have subsisted almost entirely by wild resources (defined as resources that living members have not themselves intentionally bred or planted). Another 20 or so procured at least 90 per cent of their calories from the wild, and a further 20 probably obtained 75 to 89 per cent of their calories from foraging.

These foragers all depended for their main carbohydrate source on starch leached from the pith of the wild sago palm (*Metroxylon* sp.), a dependable carbohydrate larder with a high calorie/labour-input ratio. Assuming a moderately active, average adult forager's daily caloric needs to be between 2000 and 2500 Kcals, half an hour's work was usually adequate to furnish an entire day's energy requirements (Roscoe 2005). As rich as it is in calories, though, sago yields virtually no protein, fat, or other nutrients. Forager populations were therefore critically dependent on aquatic and terrestrial game for their full dietary needs, and the proportion of each had major implications for their density, settlement size, mobility, social-scale, organization, and cultural complexity.

Hunter-foragers, as I shall call them (Table 1.1), combined wild sago with hunted game – wild pigs, the occasional cassowary, and a vast array of other terrestrial, arboreal, and avian species. *Fisher*-foragers, located in the environs of major estuaries, rivers, and lakes, combined wild sago with aquatic fauna – primarily fish and shellfish. A third category, *trader*-foragers,

Table 1.1. *Classification of forager communities mentioned in the text.*

Hunter-foragers	Fisher-foragers	Trader-foragers
Berik	Asmat (Central)	Kwoma (Hill)
Edopi	Jaqai	
Isirawa	Karawari	
Kauwera	Purari	
Kwerba	Waropen	
Mamberamo Kwerba		
Mander		
Sanio-Hiowe		

were either fisher-folk who exported a portion of their harvest to trade partners in exchange for sago, crops, or both, or they were fisher-folk by proxy, exporting surplus sago to procure fish and crustaceans.

As appears to true of foragers generally (Kelly 2013: Chapter 9), there were marked differences in the cultural contours of groups that subsisted on terrestrial game and those dependent directly or indirectly on aquatic fauna. Hunter-foragers generally had lower densities, greater residential mobility, smaller polity sizes, and greater egalitarianism than *fisher*-foragers and *trader* foragers, most of whom inhabited larger, nucleated, permanent settlements and were characterized by readily observable differentials of power and status (Roscoe 2006).

Many authors invoke food storage to explain these power and status differentials (e.g., Kelly 2013; Testart et al. 1982). None of New Guinea's forager populations, however, practiced any significant level of storage: in these tropical environments, food resources were 'stored' in their landscapes. What did differentiate these communities was the distribution of their populations across the landscape, and this difference was pivotal in determining the scale of the power differentials they supported.

Foragers, inequality and differentials of power

Power is at the heart of political centralization, the concentration of social power in the hands of a few. Research on political evolution, though, has largely treated power, its properties, and its construction tangentially rather than focally (for an important exception, see Haas 1982: Chapter 6). Social power (hereafter, *power*) is profitably defined as the capacity to secure outcomes through the agency of others (Giddens 1979: 88–94; 1984: 14–16). More prosaically, it is the ability of agents to get things done through the action of others, whether it be exacting their tribute, soliciting their labour for a project, sending them off to fight in one's interests, or a myriad other capabilities.

As Holocene history demonstrates, differentials in power can develop markedly both within and across societies. Some agents come to possess more power than others, and some polities become politically centralized while others remain comparatively egalitarian. The key questions, then, are how power differentials are built, what drives their expansion (the number controlled) and escalation (the level of control), and what constrains their magnitude at different points across space and time?

The mechanics of political centralization

Power differentials are constructed using resources or capital, assets that agents can deploy to induce or coerce the behaviour of others so as to get things done through their agency (Giddens 1979: 69, 91–2). Archaeologists and many anthropologists commonly think of capital in economic terms (e.g., gold, money, food, the means of production, etc.); but, as Bourdieu (1986) pointed out, agents have access to other forms of capital as well. In addition to economic capital, he identified cultural (or human) capital (e.g., learning, prestigious tastes or speech patterns), social capital (e.g., membership in a clan, guild, elite club, secret society, political party), and symbolic capital (e.g., prestige, honour, distinction). Other forms of capital that he failed to mention but are important to constructing power in small-scale societies include martial capital (e.g., brawn, weaponry, defensive works) and ritual capital (e.g., religious office, command of occult forces).

Whatever its form, capital shares the essential political property that access allows one agent to deploy it to induce, coerce, or otherwise motivate the behaviour of others. Assuming, *ab initio*, a non-uniform distribution across a population of political ambition, ability, and other politically relevant cognitive, affective, and physical characteristics, a potential therefore exists for power differentials to emerge between more and less politically gifted agents (Hayden 1995: 20). Those endowed with exceptional ambition, Machiavellian flare, cognitive and affective acuity, sociological perceptiveness, and so on are better equipped than others to accrue and deploy capital to their political advantage. Assuming, then, that these agents have interests that can be advanced by acquiring power, it is in their interests to try. To build differentials of power, however, they need more than just their own talents. They must in addition be able to interact with others; and they must have privileged access to capital that is capable of influencing those others.

The ability to interact directly or indirectly with others is critical, because it is only through interaction that gifted agents can deploy capital to sway the behaviour of others. The more people they can interact with, and the more time they can devote to each of these interactions, moreover, the greater will be the number of people they can induce or coerce and the more effectively will they be able to control them.

Gifted agents must also be able to deploy resources to which others attach some value. In most contexts, food is more important to people than rocks and therefore more valuable for influencing their behaviour. In arid environments, irrigated plots commonly produce more food and hence are economically more valuable than unwatered lands. The greater the value of a resource, moreover, the greater the potential power differentials an agent can construct. Food is more valuable in times of scarcity than abundance. Water is more valuable and hence politically potent in a desert than a tropical environment. Firearms are generally deadlier, and hence coercively more valuable, than spears or arrows.

However valuable a resource, though, it is politically worthless unless an agent can also *command* or *monopolize* it, excluding others in at least some degree from access. Air is exceptionally valuable to humans, for instance, but as a global public good it is of no political value because it is impossible to monopolize. By contrast, concentrated or 'spot' resources such as stored food, irrigable land, irrigation water, copper, tin, oil, and firearms are politically significant because they are more easily surveilled, stockpiled, and defended against access by others. The more monopolizable a resource, furthermore, the greater its political functionality. Commodities available only through trade are more easily monopolized than commodities in local abundance. The invention of iron smelting, by report, eroded Bronze Age leadership in northern Europe because, in contrast to copper and tin, which commonly had to be imported from afar, iron ore was locally abundant (e.g., Kristensen & Larsson 2005).

Egalitarianism, reverse-dominance hierarchies and the dialectic of control

Scholarly explanations for the quasi-egalitarianism of hunter-foragers such as the !Kung and Hadza, who depend mainly on terrestrial game for the faunal component of their diet, commonly point to a prevailing ethos or rule-set that asserts or ensures the autonomy of the individual, along with the use of gossip, ostracism, and other 'levelling mechanisms' to undermine 'bossiness' and other hierarchical behaviours (e.g., Boehm 1993; 1999; Lee 1979: 457–61; Stibbard-Hawkes, this volume; Woodburn 1982). It is certainly plausible that cultural imperatives such as these are important in the *social reproduction* of egalitarianism. An ethos that everyone *should* be equal or a rule that they must share, coupled with levelling-mechanism enforcement should have at least some effect in socializing people into treating everyone *as* equals.

But these arguments offer no obvious answer to the question of *why* communities like the Hadza and !Kung are so egalitarian to begin with. How did they come to be? If we are to avoid cultural reification, we cannot suppose that ethoses or rule sets alone somehow operate to ordain and enforce egalitarianism behind people's backs, so to speak. Nor can we accept that members deliberately shape these systems to be egalitarian. For one thing, these societies do have leaders, albeit in very attenuated form (Lee 1982; Kelly 2013: Chapter 9; Woodburn 1982), so we should have to advance the eccentric claim that members shape their systems to be quasi-egalitarian, not egalitarian. For another, egalitarianism in such a system would exist as an unstable equilibrium. It would take just one politically gifted individual with an interest in acquiring power for power differentials to emerge.

A focus on power and its properties, however, offers a way of thinking about hunter-forager quasi-egalitarianism and how it came to be that is both more precise and productive. First, it provides a more precise analysis of the day-to-day operation of egalitarianism in these communities. The key point is that power is not a capacity that one agent has and another does not. All humans have access to at least some monopolizable capital and therefore some power; even the prisoner in solitary confinement can resort to 'dirty' protests or hunger strikes to influence the behaviour of a captor. Power, in other words, is not something that one person exercises over another; rather, it is something that people continuously contest, drawing on the various capitals at their disposal, in what Giddens has termed 'a dialectic of control' (1984: 16). In other words, whether and whatever power differentials emerge in a society are the ongoing outcomes of this dialectic.

A defining feature of most hunter-forager societies is that people have access to much the same material and coercive resources, at least within broad age-sex categories (Woodburn 1982; Kelly 2013: Ch.9), and therefore to power. This is not to deny that ambitious and talented agents may gain a slender edge in access to capital, which they can deploy to construct slight power differentials. But with access to capital so finely balanced across the community, they must be very careful in exercising their advantage. If they overstep its limits, others in the community can draw strategically on their own access to capital and slap them down: notably, by deploying shame and ostracism (cultural capital) and, *in extremis*, elimination (martial capital, frequently combined with social capital; see Sibbard-Hawkes, this volume). To call these systems reverse dominance hierarchies (Boehm 1993) is to misunderstand what is going on. In deploying 'levelling mechanisms', members are not seeking to dominate but to resist behaviour that, in the prevailing circumstances, is excessively and imprudently dominant. It is, as Erdal & Whiten characterize it, '"counterdominant" behaviour rather than a reversal of hierarchy' (1994: 177).

An analytical focus on power and its properties, in sum, tells us that when hunter-foragers profess an egalitarian ethos, they are describing a state of affairs (how things *are*) as much as they are citing a principle that prescribes those affairs (how things *should* or *must* be). So how do we explain this state of affairs? Why are so many hunter-forager societies so egalitarian? The further, arguably more important advantage of focusing on power and its properties is that it provides an explanation of the level to which power differentials can rise, and thus for why political centralization varies across space and time. For our purposes, it allows us to understand, within a single analytical frame, *why* hunter-forager communities are so egalitarian and why other societies such as fisher-foragers and trader-foragers are not.

Affordances and time-space variation in political centralization

The factor that constrains or enables the scale to which power differentials can rise in a society is the prevailing physical and social environment, or what Gibson (1979) has more precisely called 'affordances'. The capacity of politically gifted agents to interact with others, the value of the capital they can deploy in these interactions, and their ability to monopolize these resources all depend on what the material and social environment 'offers the animal, what it provides or furnishes, either for good or ill' (Gibson 1979: 127). In small-scale communities, for instance, access to good quality but scarce clay enables the production and distributional control of valuable pottery goods. Subsistence adaptations that discourage nomadism and enable sedentism ease the ability of gifted agents to locate and interact with others, to stockpile and protect access to economic resources, and, to the degree people are tied down and reluctant to 'vote with their feet,' to deploy coercive resources to influence their behaviour. In more complex techno-organizational systems, mechanical transport, literacy, print, and electronic communications allow political agents to interact with vast audiences; differential access to communications enables their manipulation of desire and fear; and privileged access to economic and other forms of capital provide them with differential access to the means of communication.

Since the number and combinations of affordances in different material and social environments approach infinity, it follows, as archaeologists and prehistorians have documented, that the forms and trajectories of political centralization will vary markedly across space and time. Nevertheless, we can identify a number of affordances that were so common in prehistory as to create commonalities among these trajectories. In what follows, I examine the most important of these affordances as they affected the construction of power differentials across the New Guinea forager spectrum: the division of labour, mobility, and the distribution of population.

Asymmetric power, the division of labour and population distribution across landscapes

The ability of gifted agents to build power relations is critically affected by their time budgets: the more time they can devote to political interaction, the more people they can control and/or the more effectively they can control them. In small-scale societies, though, social organization and demography conspire to limit the time they can allot to political interaction. The first problem is a rudimentary division of labour, which severely limits their ability to shift non-political responsibilities – subsistence, social, and other, non-political tasks and obligations – onto others. In these societies, a political agent who devotes all his or her time to political interaction will struggle to find food, shelter, and raise children.

A second burden is the time they must spend bringing political interactions about. In these societies, all communication is face-to-face, and all movement is either on foot or by canoe. The proportion of their time budgets that they must spend in travelling between political interactions as opposed to interaction itself is therefore profoundly influenced by people's distribution across the landscape – their density, the degree to which they are clumped or dispersed, and their mobility (Roscoe 1993; 2012; 2013). In sparse, dispersed populations, much of their political time budget must be 'wasted' in travel rather than interaction. If the population is also nomadic, they must add a search component to their travel time.

Figure 1.1 models the problem for a political agent travelling at 5 km per hour between people distributed at the centres of hexagonal cells arrayed in a grid across a flat plain.[1] At a density of 0.1 person per sq. km, the time such an agent must devote to travel is 3.2 times greater than at a density of 1.0 people per sq. km, and 7.1 times greater than at 5.0 per sq. km. If the population is nomadic, travel times are greater yet. Conversely, political agents operating in a sedentary population with a density on the order

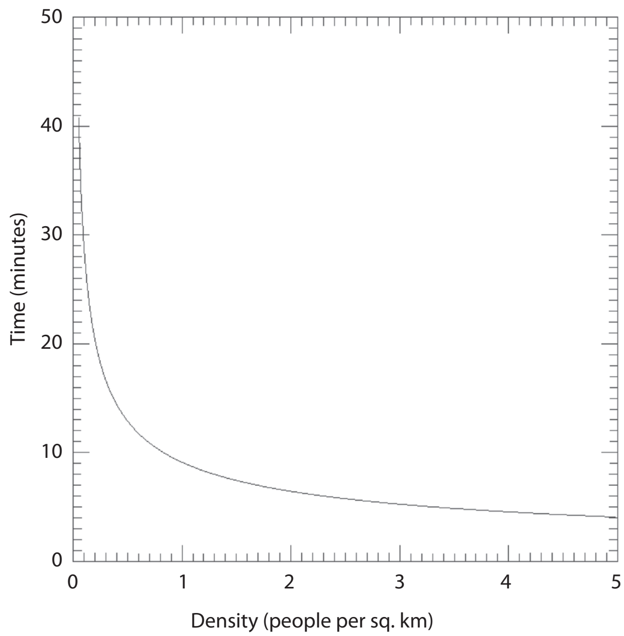

Figure 1.1. *Nearest neighbour travel time against population density in a population distributed at the centres of hexagonal cells arrayed in a grid (travel velocity = 5 km per hour).*

of 370–500 per sq. km – densities that prevailed on the coastal plains of contact-era Tahiti, for instance – will find scores of people with whom to interact, virtually on their doorstep.

One reason why !Kung communities are so egalitarian, as we have noted, is that members all have more or less similar access to politically valuable capital. But even were this not the case, they would still be egalitarian because any agent aspiring to construct power differentials over a mobile population scattered across the Kalahari at a density of just one person per sq. km, would have to waste most of their time wandering around the desert just to find someone beyond his or her immediate band to manipulate. The barrier to constructing power is so great that it is hardly worth the bother, and it should not surprise us that the !Kung are so famously egalitarian in ethos and behaviour.

Competing for power

So much for theory; in practice, things are more complicated. For one thing, political talent and ambition are not dichotomously distributed across a population; they exist on a spectrum from the exceptionally ambitious and gifted to the outstandingly apathetic and challenged. Instead of hierarchies in which power is dichotomized – a single gifted agent at the top and everyone else at the bottom – we should therefore expect gradations of power within a hierarchy, agents holding sway over others in proportion to their political ambitions and abilities.

In many eventualities, moreover, we should expect an interacting population large enough to contain several equally gifted agents to host something close to an equal number of hierarchies. This is because these gifted agents each enjoy a travel-cost advantage in constructing power over others in their immediate neighbourhood. Individuals living on *their* doorstep are rather more distant from the doorsteps of *other* gifted agents. Instead of a single, overarching power hierarchy, therefore, a large population may accommodate several hierarchies, each competitively created by an especially gifted political agent.

Finally, agents talented enough to place others in their thrall face a kind of 'optimal political foraging' problem. They must reckon how best to apportion their political time-budgets between *extending* their influence over others and *enhancing* that influence in order to optimize their payoffs. To what extent can they improve their rewards by placing large numbers of people under their control as opposed to increasing the compliance of a smaller number?

Population distribution and power in New Guinea's contact-era forager societies

Although the precise mathematics of power construction are clearly complex, the implication of the foregoing is not. We expect mobile, low density, dispersed populations to be politically more egalitarian than sedentary, higher density, nucleated counterparts. This is precisely what we find when we compare a sample of 12 of New Guinea's contact-era hunter-forager groups to a sample of 18 fisher- and trader-foragers. The hunter-foragers had a median density of 0.5 people per sq. km, compared to a median density of 3.0 per sq. km among the fisher- and trader-foragers. The hunter-foragers were also much more mobile, spending the majority of the year moving around the landscape in small, one- or two-family camps of perhaps 8–10 people, and aggregating only occasionally in a central settlement of median size 45 for social and ceremonial purposes (Roscoe 2005: 560–4). In contrast, almost all of the fisher- and trader-foragers inhabited large, permanent settlements with a median size of 210 people (ibid.).

The consequences of these differences for the construction of power were stark. A political agent operating in a median fisher-forager/trader-forager village of 210 people would need to spend only 10.2 minutes to travel between all of its 53 politically active men (assuming that people inhabit hexagonal living areas of 100 sq. m per person, that one quarter of the population comprises politically active men, and that agents travel at a speed of 5 km per hour). Even if hunter foragers had lived permanently in their central settlement rather than dispersed in mobile camps for most of the year, though, a political agent in the median hunter-forager group of 45 people living at a density 0.5 per sq. km would have had to spend almost 330 minutes travelling the landscape to interact with the same number of politically active men (with previous assumptions and that settlements are located on a flat plain at the centres of hexagonal cells arrayed in a grid).[2]

A contact-era political agent hoping to build a power base in a median New Guinea hunter-forager group thus faced travel costs that were more than 32 times that of his or her counterpart in the median fisher-forager/trader-forager group. Ethnographic work on leadership in these communities confirms what we would predict. Observers of hunter-forager groups were at pains to stress just how egalitarian they were. Among the Edopi of the Lake Plains, there was 'no concept of a headman…, all the adult male members of a clan having equal status' (Kim 1997: 202). 'Every traveling researcher until now,' Oosterwal observed of the Berik, Isirawa, Kwerba, and Mander of the Upper Tor River, 'was surprised to encounter in these villages no tribal chief and not once a village elder. Everyone is the same, no-one has more say than another….. Everyone is equally poor or equally rich, however one looks at it. Everyone occupies the same place in their community. The elders here have no more say than youths…. Men and women also stand equal' (1963: 99, my translation). On the eastern banks of the Mamberamo, Oosterwal also found that Kauwera and Mamberamo Kwerba people all 'have equal say in village affairs' (Oosterwal 1967: 166–7). So too the Sanio-Hiowe of the Sepik Hills: 'Formal leadership is lacking and informal leadership is weak' (Townsend 1969: 8).

Ethnographers spoke in very different terms about contact-era, fisher-forager and trader-forager villages. Here, we encounter no ethnographic assertions of political equality. To the contrary, observers noted the presence of men who enjoyed not just power but positions that were ascribed either *de facto* or *de jure*. Among the Central Asmat of southeast New Guinea, leaders resembled the well-known Big-man type. 'Each moiety [in a village] had a leader and it seems that this position of leadership was achieved…. [These] were men of strong personality who could exert their will on others' (Mansoben 1974: 53–4). Eyde (1967: 233–4) noted, though, that the sons of powerful men usually inherited rights to more sago and fishing areas and had more brothers to support them than those whose fathers were less powerful, giving them a genealogically defined advantage in coming to power. Among the Purari (or Koriki) and Waropen, the situation was reversed: leadership was ascribed but leaders also had either to achieve their power or to consult with others in the community who had achieved power. Thus, 'traditional Koriki leadership was an ascribed status….In addition, personal competence was a factor, including some of the attributes of the "big man"' (Maher 1967: 313). Likewise, 'one is fully entitled to speak of a system of chieftains among the Waropen, where it is based on certain hereditary privileges and on descent' (Held 1957: 71). However, 'the clan-chief can do little by himself and therefore he always acts in consultation with other influential men….the great men, i.e. the well-known warriors and the leaders of the various important family-branches' (Held 1957: 75).

Status, social inequality and hierarchies of dominance and prestige

Power does not exhaust the catalogue of social inequalities in human society. There is also status, a term that Henrich & Gil-White (2001: 166–7) have usefully pointed out commonly conflates two very different phenomena in public and academic discourse: dominance and prestige. Dominance is generally defined as a superior ability directly or indirectly to intimidate or inflict costs on others (e.g., Henrich & Gil White 2001: 166–7; von Rueden 2011: 2223). This is very different from prestige, which is best defined as a (moral) approbation that a community affords agents who are perceived to exemplify qualities, perform activities, or fulfil roles to which the community attaches value (e.g., Johnson et al. 2007: 346; Riches 1984: 235).

This distinction between dominance and prestige doubles our explanatory task, presenting not one but two phenomena to explain. An analysis of status in contact-era New Guinea, however, strongly suggests that the task is simpler than it seems: in small-scale societies at least, dominance and prestige hierarchies emerge from the same social root, a conflict-of-interest dilemma.

The conflict of interest dilemma in small-scale societies

Researchers across the social-sciences have developed an enormous literature on how humans manage cooperation, collective action, and the free-rider problem in groups larger than the coping spans of inclusive fitness and the human cognitive competency to tally ongoing reciprocal transactions. The shortcoming in this literature is that it overlooks – or, at the very least, assumes away – a conflict-of-interest problem. It is often mutually advantageous for humans to interact peacefully – to form an enduring social group or gather in large physical aggregations. In New Guinea, for instance, villages and clans were social groups that formed for the mutual defence of their members (Roscoe 2009: 80–8); in forager societies, it may be advantageous for several families or bands to aggregate physically around clumped, seasonal resources such as fish runs. But if these groups and aggregations are large, how do members manage competition over reproductive, subsistence, and other interests without these conflicts erupting into physical and lethal violence, which would be costly to all sides and threaten the advantages at stake in grouping or aggregating?

This conflict-management challenge is particularly pronounced in egalitarian and trans-egalitarian communities. Large, politically centralized states have the capacity to create and maintain centralized institutions of detection, mediation, adjudication, and sanction to institute and enforce a governmental claim to monopolize physical violence. Egalitarian and trans-egalitarian communities, though, lack these centralized organs of control. Discussion, kin-group pressure, gossip, ostracism, exclusion, and other measures are not without effect in limiting the threat of internal conflict in small-scale society, but in the absence of third-party systems of mediation, detection, and enforcement backed by a centralized power, small-scale polities are chronically vulnerable to conflicts of interest that can spiral into lethal violence, threatening lives, coalitions, and communities.

Resolving the conflict-of-interest dilemma

How then do small-scale communities and large physical aggregations manage this problem? In New Guinea, I have argued elsewhere (Roscoe 2009; 2013), they deployed a strategy common to most animal species characterized by a high expected future fitness-value: non-serious fighting displays (Enquist & Leimar 1990). In these species, conflicts over mates, resources, sanctuaries, and so on are managed not by dangerous fighting but by honest signals of fighting strength such as physical displays (e.g., parallel walking, bellowing), threat displays (e.g., teeth-baring, charging), and trials of strength (e.g., head butting, tail biting, or pushing contests). In these contests, competitors of approximately equal fighting strength are able, to their mutual advantage, to assess which of them would win a fight to the death without either having to incur the potentially catastrophic risks of an actual fight to the death (e.g., Clutton-Brock et al. 1979; Enquist & Leimar 1990).

The result of such contests is a *dominance hierarchy*. Those individuals who consistently signal superior strength can expect to prevail in conflicts, be they over mates, material resources, or some other reward, while those who fall short are obliged to defer. Such a system benefits every individual, even those who have to defer, because none need risk the physical costs of actual fighting, while all benefit from maintaining the integrity of their alliances or coalitions.

The deployment of honest signals of fighting strength to establish dominance hierarchies is so widespread in animal species (Stibbard-Hawkes, this volume) that it would be somewhat surprising if they were absent from human society. The New Guinea evidence strongly suggests that, indeed, they were present and in particularly elaborate form. It was not just individuals who signalled their fighting strength in dominance competition but sub-polity groups and allied polities as well, a system that maintained the integrity of their polities and inter-polity alliances in addition to lowering the morbid and mortal costs of conflict.

In New Guinea, the most reliable means of signalling military strength was to deploy it in lethal practice – not against competitors within one's polity or allied polities, which would defeat the purpose of the exercise, but against enemies. Individuals, sub-polity groups, and polities that proved themselves in war against enemies abroad authentically demonstrated their military strength to individuals, sub-groups, and friendly polities closer to home.[3] In the event of conflict, individuals and groups with reputations for superior performance in war could then expect others within their own or allied polities to defer to their interests.

The second – and arguably more important – means of signalling fighting strength was a kind of ceremonial or symbolic fighting, Collectivities mounted ceremonial displays that served as honest signals of the numbers they could muster to their cause, the commitment of those numbers to their cause, and the ability of these numbers to submerge their identity in that of the collectivity and act *as* a collectivity to advance the cause. These displays assumed three principal forms: conspicuous material distributions, conspicuous performances, and conspicuous constructions. Conspicuous distributions took the form of public prestations; the most important were the feasts, pig-kills, and pig-and-shell-valuable exchanges that accompanied most life-cycle rites and competitive exchange ceremonies, but they included less elaborate forms of public gifting as well. Conspicuous performances revolved around large and elaborately choreographed exhibitions of singing, dancing, and music, mounted by spectacularly decorated performers. And conspicuous construction involved the erection of massive cult houses or men's houses, material structures that archaeologists would readily term monumental constructions had they been built from stone or brick rather than organic materials.

Their varied forms notwithstanding, the scale, complexity, and frequency of ceremonial displays all functioned as indexical signals of individual and collective military strength. At the individual level, the number and size of the pigs, shell valuables, food, and other prestige-economy items that individuals contributed to a material display, the vigour, endurance, and flair of their singing and dancing performances, and the labour and organizational, engineering, and artistic talents they brought to a conspicuous construction were all honest signals of their physical and cognitive strength. What went for the individual applied also at the collective level. The amount of material goods a sub-polity group or polity could muster for a conspicuous distribution was an honest signal of the personnel, kin, and allies it could mobilize in its interests, their commitment to its projects, and its capacity to act as a collectivity. Mementoes of these distributions were subsequently displayed in the form of skulls or jawbones of the game contributed to a feast, insignia of the number, length, and girth of the pigs given away, and tallies of the shell valuables transacted.[4] In a conspicuous performance, the number of participants, the intricacy and synchronization of their dancing, the volume and harmony of their singing, and the length of time they could keep it all up signalled the same strengths. In the case of conspicuous construction, the signal was the sheer size and rococo artistry of the structure and the plastic art associated with it. Together, such displays demonstrated in the most public and authentic of ways the strength their sponsors could bring to a physical fight should they wish.

Signalling strength in New Guinea forager society

The evidence supporting this argument for New Guinea as a whole is documented at length elsewhere (Roscoe 2009: 89–101). To focus here on the forager evidence, we find three principle strands of support: New Guinean foragers apotheosized fighting strength; they viewed material generosity and ceremonial displays as demonstrating that strength; and they cast these behaviours as a kind of symbolic warfare.

Because hunter-foragers were so egalitarian and their leadership minimal, data on what these people valued in masculinity is slight. It is clear, nevertheless, that they esteemed men who had established a reputation for fighting strength. Notwithstanding the general equality that characterized Upper Tor groups, homicidal revenge was seen as 'a means to gain status [*Ansehen*] and power [*Macht*]. The greater the number of people that one kills, the higher climbs one's personal status and personal power' (Oosterwal 1963: 94, my translation).[5] Achievements in hunting, which shares many of the same skills and some of the dangers of fighting also brought status (Oosterwal 1961: 96; 1963: 31). Among the Kauwera and Mamberamo Kwerba, too, the opinion of 'a mighty warrior' or 'great hunter' weighed more heavily than anybody else's (Oosterwal 1967: 166–7).

The idealization of individual and collective male strength was particularly evident among fisher- and trader-foragers. To be a 'strong man' among the Purari was to be 'an individual of social importance' (Williams 1924: 64). The most esteemed male quality among the Waropen was '*kako,* rough, hard, cruel, i.e. *the Waropen idea of martial virtue*' (Held 1957: 66, emphasis added). The ideal Jaqai man was 'strong, brave, diligent and generous' (Boelaars 1981: 90–1); he was a man 'able to fight for [his] own interests and those of [his] relatives' (Boelaars 1981: 90). Among Karawari foragers, who based their subsistence on a mix of hunting and fishing, an 'aggressive, ambitious, energetic, and dominant man… is feared but admired and followed by others. He represents security and protection from the threat of potential enemies, sorcerers, and dangerous spirits' (Telban 1998: 58). Among the Hill Kwoma, who traded wild sago for aquatic resources to the Manambu, the admired male was possessed of *ow*: 'potency, effectiveness (in ritual and other contexts), force in the sense of physical strength, energy and aggressiveness' (Bowden 1983: 92). 'A dog growling in defence of a bone is…said to display *ow*' (Bowden 1983: 93).

A second line of evidence is explicit ethnographic statements that material generosity and ceremonial displays did indeed index strength among New Guinea's foragers. For the Upper Tor groups who, like many others, combined conspicuous material distributions with conspicuous performances: '*The best means for convincing other clans of one's own excellence and strength is the organizing of festivals*. The larger a festival and the more princely the entertainment of the guests, the higher climbs the status of the host. Above all the entertainment causes shame and awakens the greatest envy [in the guests]. Later, when the guests themselves become hosts, they will try to collect still more food and to entertain in even more princely fashion, *in order in this way to be able to restore their status and their might*' (Oosterwal 1963: 85, my translation, emphasis added).

What went for groups went for individuals as well. Among the Purari, a 'man of consequence, an *a'a venea*, is the man who kills many pigs, who organises feasts, who makes his voice heard and his presence felt. Liberality is held perhaps to be the first of the virtues; but energy or skill in the common cause will likewise make an *a'a venea what the interpreters always call "a strong man"*' (Williams 1924: 74, emphasis added). The sheer size of a great Purari cult house (or ravi) – a conspicuous construction that could range up to 400 ft long and 100 ft at its apex (Bevan 1890: 243) – was 'a true indication to the visitor of the size of the village and its population' (Holmes 1924: 93).

Perhaps the best evidence that foragers saw ceremonial displays as signals of military strength, though, was that they cast them as non-violent forms of fighting. Oosterwal characterized the 'dance, song, meals, festivals, and religious celebrations' of the hunter-forager tribes of the Upper Tor as a major element in how they waged 'an eternal, lasting strife concerning [who had] the greatest strength and the highest status. This fight is in large part the meaning of their lives' (1963: 83, my translation). He found the same among the Kauwera-speaking Muremarew on the east banks of the Mamberamo: 'Every dancing feast is a "fight"' (Oosterwal 1967: 173). Tellingly, he referred to the food distributions in these festivals as like a 'potlatch' (Oosterwal 1961: 238), the Northwest Coast displays that Codere (1950) famously characterized as 'fighting with property'. Held used the same term of Waropen material distributions (1957: 226), referring to them as 'contractual battle[s] of gifts… fought in public' (1957: 78).

Nor was it just material distributions that had violent overtones, as Oosterwal made clear of Kwerba festivals in the Upper Tor. 'The dance also belonged to the strength fight. Suddenly, the Naidjbeedj men Idabon, Négwan, Bannie and Bilei-jam stormed onto the village piazza…. With wild springs, they "danced" from one end of the piazza to the other. By this, they wanted to challenge the Bora-Bora to seize their drums and take up the fight with them…. During this, they called, "Waba, Waba, Waba" and other war calls. Four jumps forward, four back. So flowed the attack back and forth…. The whole village was now dancing, sometimes a couple of hundred people. As they did so, they sang the old songs of fighting and victory' (Oosterwal 1963: 87–8, my translation). Kauwera lineages engaged in similar song-and-dance 'fights': 'Since none of the members likes to give up first, it becomes very exhausting…. Generally, in about an hour the first "casualty" occurs. Totally exhausted, a man falls to the ground and is considered "dead." …Sometimes the "fight" is so severe that the dance is prolonged for a week or more' (Oosterwal 1967: 173).

Social inequality, status and prestige hierarchies

A system resting on honest signals of fighting strength contains within it a solution to the free-rider problem. Displays of conspicuous material distribution, performance, and construction are arduous and time-consuming activities, so in theory the system is vulnerable to individual and even collective defection. In practice, though, it rewards individuals and groups in proportion to the contributions they make to their own and their collectivities' fighting strength. Those who contribute most to displays of fighting strength are those who become dominant and can therefore advance their interests over those who would free ride. Simply put, individuals and their groups are rewarded in proportion to the efforts they put in.

At the same time, the system generates a prestige hierarchy, a hierarchy of (moral) approbation afforded agents who are seen to exemplify qualities, perform activities, or fulfil roles to which a community attaches value. It is reasonable to assume that communities attach value and therefore prestige to those who behave in prosocial ways. In forager societies, these behaviours generally include generosity with meat and other food and goods, advice and information, organizational skills, and other contributions that advance cooperative ventures, including the conspicuous ceremonial displays that determine sub-group and polity dominance. To the extent these actions are performed publicly, though, they not only recruit prestige but also signal fighting strength. Those who provide such benefits, therefore, not only become esteemed but also dominant and capable of advancing their interests over others'.

The result is a hierarchy in which those at the top are both dominant and prestigious, simultaneously evoking both apprehension and admiration in those below. This curious duality may explain why, in common usage, the term *status* conflates both dominance and prestige, which in turn may account for why ethnographers seldom seem to have noticed that those who demonstrated strength in New Guinea provoked both apprehension and appreciation in others. Nevertheless, it was apparent among the Yangoru Boiken (Roscoe 2009: 103) and Manambu (Harrison 1993: 120–1), and Telban noticed it among Karawari foragers. 'An aggressive, ambitious, energetic, and dominant man, who may be referred to as 'bad', is feared but admired and followed by others. He represents security and protection from the threat of potential enemies, sorcerers, and dangerous spirits….Potency and self assertiveness in such men, though in many ways antisocial, are none the less admired' (Telban 1998: 58; see also Bowden [1983: 113] on Kwoma trader-foragers).

Conclusion

Although I have dealt with power and status as though they were separate phenomena, in reality they are intimately linked. In common parlance, status can refer to position in hierarchies of both dominance and prestige. In the guise of dominance, it is a form of martial capital;

in the New Guinea case, a reputation for superior fighting strength derived from performance in war, conspicuous ceremonial, and other public actions. In the form of prestige, status is a type of symbolic capital; in New Guinea, a reputation for prosocial behaviour derived from much the same activities. We are thus back to power and capital: in both of its semantic refractions, status reduces to forms of the capital that undergirds power.

I began this chapter with a claim that most of the meanings people attribute to the term *social inequality* – economic inequality, social stratification, political inequality, and so on – can be analytically encompassed by attention to power and status. In the knowledge that status reduces to forms of capital, then, let me conclude by redeeming this assertion. Observe first that the different inequalities encompassed by the term *social inequality* are all inequalities in access to either different forms of capital or, in the case of political inequality, capital in general. Economic inequality denotes inequality in access to economic capital; social stratification is an unequal access to symbolic capital (and, in many cases, social capital); and so on. Second, it is power and capital acting in tandem that generates these inequalities. Capital is the vehicle for the exercise of power, but power is a capacity that can be used to beget capital. Gifted or otherwise advantaged agents may, for instance, use access to martial capital to extort economic resources from others, thereby generating economic inequality. They may then be able to deploy this economic capital to contract labour, which they can then use to generate more economic capital and intensify economic inequality. Additionally or alternatively, they can deploy their access to economic capital to purchase or bribe access to social capital – membership in a guild or secret society, perhaps – which may confer symbolic capital (honour, distinction) as well, these two capitals in combination reflecting and widening levels of social stratification. As a condensed form of both martial capital and symbolic capital, status can provide privileged access to mates, material resources, and other payoffs, generating reproductive and other inequalities. And so on. Attention to the nature of power, the properties of different forms of capital, and the mechanics of constructing power differentials, in sum, offer not only a way to analyse the levels of social inequality that can develop in a society but also an entrée to more fully comprehending the several forms that inequality can take.

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Notes

1. The relevant equation is: Mean nearest neighbour travel time = $9.1176/\sqrt{D}$, where D is density (per sq. km) and assuming a travel speed of 5 km per hour.
2. The general form of the equation is:

$$T = \frac{\left(N*45.588*\sqrt{\frac{A}{M}}\right)}{V} * \left(1 - \frac{1}{M*P}\right) + 45.588 * \left(\frac{N}{M*P} - 1\right) / \left(V * \sqrt{\left(\frac{D}{P}\right)}\right)$$

   where A is living area per capita (here, 100 sq. m); D is population density (per sq. km); M is the proportion of politically active men in the population (here 0.25); N is the total number of politically active men with whom the agent interacts (here, 53); P is settlement population size; and V is travel speed (here, 5 km per hour).
3. At least 82.6 per cent of 92 New Guinea communities (forager and non-forager) on which leadership data are available were reported to afford eminence, influence, or both to men who had distinguished themselves in war (Roscoe 2017: 204–5).
4. *Mementoes*. **Abelam (Central)** – Lea 1964: 59, 116; **Bedamini** – NMD 1966/67: 5; **Berik** - Oosterwal 1963: 89; **Boiken (Yangoru)** – Roscoe n.d.; **Mer** – Haddon 1912: 131–2; **Telefomin** – Craig & Hyndman 1990: 235, 263.
5. The German terms *Macht* and *Ansehen* can be translated in several ways. In addition to 'power' or 'strength,' as I translate them here and below, *Macht* can also mean 'might,' 'potency,' 'force,' and 'authority.' *Ansehen* can mean not only 'status' but also 'reputation,' 'esteem,' 'respect,' 'eminence,' and 'prestige,' among other things. I have chosen 'status' because it is the term Oosterwal uses most often in his English publications.

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Chapter 2

Mobility, autonomy and learning: could the transition from egalitarian to non-egalitarian social structures start with children?

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In recent years, increasing numbers of archaeologists are employing creative means to consider the lives and roles of forager children in the past (e.g., Finlay 1997; Hildebrand 2012; Kamp 2001; Lillehammer 1989; Ruttle 2010). These researchers are still in the minority among archaeologists, however; even though children make up thirty to fifty percent of ethnographically documented forager bands (Hewlett 1991), most archaeologists tend to assume that the material culture we see from the past is largely attributable to adults. In addition, many of us rarely consider the centrality of children's learning to the process of cultural transformation (Lillehammer 2010). But children's choices do have ramifications for culture change; for example, Morelli (2017) argues that Matses children in the Peruvian Amazon choose new cultural and subsistence futures by emplacing themselves along the river instead of accompanying adults into the forest to hunt and gather. Building on research like Morelli's, this chapter argues that alterations to children's learning environments may have ripple effects throughout their society's social structures, making children themselves vital agents of cultural change.

Archaeologists have found repeatedly that decreased mobility, increased settlement size and increased labour demands are correlated with non-egalitarian social structures (e.g., Price and Brown 1985; Roscoe 2006, 2009). Specifically, sedentism is widely linked to increased cultural emphasis on competition and gender inequality. Indeed, Kelly (2013: 266) argues that 'the advent of sedentism may, after several generations, alter a population's modal personality toward one that sees social manipulation – the control of another's labor – and competition as the primary way of achieving goals.' Sociocultural anthropologists and psychologists who study children have also found that mobility, settlement size, and labour are cross-culturally correlated with changes in children's learning, personality, and behaviour (e.g., Draper 1976; Whiting & Whiting 1975). Considering these factors, in this chapter, we apply ethnographic findings from the anthropology and psychology of childhood to the archaeological debate surrounding cultural transformation. Ultimately, we argue that shifting opportunities in the social landscapes of children's learning in the past might have led to changes in child behaviour, especially in the domains of competitiveness and gender inequality.

This chapter begins by considering how children learn, and the mechanisms that promote autonomous learning within broadly egalitarian forager societies (for further review see Garfield et al. 2016; Hewlett et al. 2011; Lew-Levy et al. 2017, 2018). We then focus on two changes that may have had important ramifications for the transition from egalitarianism to non-egalitarianism. First, researchers suggest that more child-appropriate labour among settled communities, including tasks like cleaning, maintenance of possessions, food processing, and tending to animals or gardens leads to settled children being assigned more chores than their mobile peers (Bock 2002; Morelli 1997; Munroe et al. 1983). In particular, girls may experience earlier and more intensive chore assignment, placing them in the home and calcifying gender roles overall (Whiting and Whiting 1975). These cross-cultural observations lead us to argue that when mobility decreases, gender inequality develops thanks partially to increasingly gendered regimes of chore assignment for children. Second, cross-culturally research suggests that the transition from multi-age and multi-gender playgroups in small, mobile societies to same-age, same-gender playgroups in more settled societies provides children with more opportunities to play competitive games (Draper 1976). We argue that this trend toward increased competitive play among children with larger peer groups fosters a competitive ethos that follows children into adulthood. Over time, this competitive ethos becomes a foundational schema – a cultural value that 'pervades several domains of life' (Hewlett et al. 2011: 1171). This chapter does not present newly collected data to test these arguments; instead, we synthesize previous cross-cultural data from small-scale societies to consider how the processes of children's learning differ between more mobile and more settled peoples. In the end, we argue that changes in mobility, economy and work also change children's learning contexts, contributing to a decreased cultural emphasis on personal autonomy, and an increased emphasis on gender inequality and competition.

Background and methods

The arguments in this chapter are based on two previously published cross-cultural ethnographic reviews of how forager children learn social and subsistence skills (Lew-Levy et al. 2017, 2018). Using academic search tools, the Human Relation Area Files, reference lists from relevant publications and direct contact with scholars working with forager children, we gathered and read more than 500 papers and book chapters on forager children from all over the world. We then selected studies for inclusion in our analyses using three criteria. First, the societies in question had to be broadly egalitarian foragers. Second, the study had to focus primarily on learning. Third, the studies had to consider the learning of children specifically. Ultimately, we found 58 publications on how forager children learn subsistence skills (Lew-Levy et al. 2017), and 77 publications on how forager children learn social and gender norms (Lew-Levy et al. 2018), totalling 115 unique publications from 51 societies (Table 2.1). We used a meta-ethnographic approach, meaning we included publications with both quantitative and qualitative data. In the arguments presented in this chapter, we consider these previously gathered ethnographic data alongside more recently published works, research on non-egalitarian foragers, and archaeological studies of forager children.

Researchers have long placed hunter-gatherers in binary categories of either egalitarian or non-egalitarian, simple or complex, non-affluent or affluent (Keeley 1988; Kelly 2013; Price & Brown 1985). Egalitarian

Table 2.1. *Studies included in Lew-Levy et al. 2017, a meta-ethnography on learning subsistence skills, and Lew-Levy et al. 2018, a meta-ethnography on learning social skills.*

Region	Society	Publications
Africa		
Botswana/South Africa/ Namibia	San	Bakeman et al. 1990; Blurton Jones & Konner 1973; Draper 1975; Draper 1976; Draper 1978; Draper & Cashdan 1988; Eibl-Eibesfeldt 1974; Eibl-Eibesfeldt 1978; Imamura & Akiyama 2016; Imamura 2016; Nielsen & Tomaselli 2010; Nielsen, Mushin, et al. 2014; Nielsen, Tomaselli, et al. 2014; Shostak 1976; Shostak 1981; Weissner 1982
Central African Republic	Aka	Berl & Hewlett 2015; Berry et al. 1986; Boyette 2013; Boyette 2016a; Boyette 2016b; Boyette & Hewlett 2017; Fouts et al. 2016; Hewlett & Cavalli-Sforza 1986; Hewlett 1992; Hewlett et al. 2000; Hewlett et al. 2011; Hewlett & Hewlett 2012; Hewlett 2012; Hewlett 2013; Hewlett & Roulette 2016; Neuwelt-Truntzer 1981; van de Koppel 1983
Central African Republic	Bofi	Fouts et al. 2016
Cameroon	Baka	Gallois et al. 2015; Kamei 2005; Sonoda 2016a; Sonoda 2016b
Republic of Congo	Mbendjele	Lewis 2002; Lewis 2016
Democratic Republic of Congo	Mbuti	Turnbull 1978
Democratic Republic of Congo	Efe	Morelli 1997; Morelli et al. 2003
Madagascar	Mikea	Tucker & Young 2005
Ethiopia	Chabu	Dira & Hewlett 2016; Hewlett 2016
Tanzania	Hadza	Blurton Jones & Marlowe 2002; Crittenden 2016a; Crittenden 2016b
Australia and Oceania		
Australia	Indigenous (not specified)	Nielsen, Mushin, et al. 2014; Nielsen et al. 2016
Australia	Aboriginal inhabitants of Rural Town	Eckermann 1980

Table 2.1 *(cont.).*

Region	Society	Publications
Australia	Aboriginal inhabitants of Southern Arnhem Land	Cowlishaw 1982
Australia	Anangu	Eickelkamp 2008a; Eickelkamp 2008b; Eickelkamp 2011; Eickelkamp 2017
Australia	Anbarra	Hamilton 1981
Australia	Kaytetye	Thompson 2003
Australia	Kugu-Nganychara	Von Sturmer 1980
Australia	Mardudjara	Tonkinson 1978
Australia	Martu	Bird & Bliege Bird 2005
Australia	Meriam	Bird & Bliege Bird 2002; Bliege Bird & Bird 2002
Australia	Pitjantjatjara	Ilyatjari 1991
Australia	Walpiri	Musharbash 2011; Musharbash 2016
Australia	Wik	Martin 1993
Australia	Yolngu	Harris 1980
Australia	Yorta Yorta	Andrews 2008
Papua New Guinea	Gidra	Kawabe 1983; Nishiaki 2013; Ohtsuka 1989
Asia		
Malaysia	Batek	Endicott & Endicott 2008; Endicott 2011; Endicott & Endicott 2014; Lye 1997
Malaysia/Borneo	Penan Benalui	Puri 2005; Puri 2013
India	Nayaka	Bird-David 2008; Naveh 2014; Naveh 2016
India	Ongee	Pandya 1992
India	Paliyan	Gardner 1966
India	Jenu Kuruba	Demps et al. 2012
Siberia	Eveny	Ulturgasheva 2012
Siberia	Khanty	Jordan 2014
Siberia	Yukaghir	Willerslev 2007
North and South America		
USA	Comanche	Wallace & Hoebel 1952
USA	Crow and Blackfoot	McAllester 1941
USA	Delaware Indians	Newcomb 1956
USA	Gros Ventre	Flannery 1953
USA	Cultures 'from Pennsylvania and neighboring states'	Heckewelder 1876
USA	Sioux	Erikson 1939
USA	Yup'ik	DeMarrais et al. 1992; DeMarrais et al. 1994
Canada	Chippewayan	Vanstone 1965
Canada	Cree	Ohmagari & Berkes 1997
Canada	Dene	Christian & Gardner 1977
Canada	Inuit	Briggs 1970; Briggs 1972; Briggs 1978; Briggs 1979; Briggs 1991; Briggs 1994; Briggs 1998; Briggs 2000; Condon & Stern 1993; Guemple 1988; Omura 2016; Stern 1999
Canada	Montagnais	Burgesse 1944
Paraguay	Ache	Walker et al. 2002
Peru	Matsigenka	Johnson 2003
Argentina	Toba	Mendoza 2001
Argentina	Yamana	Gusinde 1937

foragers are usually mobile, have few possessions, and live in very small groups. In general, egalitarian foragers have equal access to resources, technology, and the paths to prestige (Woodburn 1980). But egalitarianism is not automatic; such groups are 'fiercely egalitarian' (Lee 1979: 24), and they employ cultural strategies like teasing, shaming, demand sharing, and threats of ostracism to keep individuals from dominating others (Boehm 1999). Egalitarianism is also reinforced by a strong emphasis on personal autonomy, which places value on individual decision-making. In general, individuals are free to choose with whom they interact, their whereabouts, their activities, and even their behaviours. Much like sharing, 'autonomy acts as a social mechanism that undermines coercion, authority, or hierarchy' (Lew-Levy 2018: 4). Non-egalitarian foragers are hierarchical, and elite classes may even possess slaves and fight wars (Keeley 1988). They also tend to accumulate material wealth, and many non-egalitarian foragers employ substantial food storage (Testart et al. 1982). In a cross-cultural survey of 33 foraging cultures, Keeley (1988) finds that food storage, population pressure and sedentism are all highly correlated with non-egalitarian social structures. Yet there is not a simple dichotomy between egalitarian and non-egalitarian societies; states of cultural inequality vary between truly egalitarian cultures where no person holds any power over others and cultures where one person may actually own another (e.g., Woodburn 1982).

We focus in this chapter on the decrease in mobility that so frequently correlates with increased populations and a related decrease in egalitarianism. However, we recognize that mobility, and small-scale economies, exist on a spectrum. Whether mobile foragers, pastoralists or horticulturalists, we are interested in the increase in group size and children's work that cross-culturally correlates with decreasing mobility and increased participation in field agriculture, or the labour economy. Because this shifting economic focus is so closely tied with shifting mobility, particularly within the timescale of prehistory, we generally use the shorthand in this chapter of discussing mobile or settled peoples.

Parental beliefs about autonomy

Ethnotheories about the nature and needs of children influence how parents will act towards children as well as how, and through what processes, children become moral, active agents within their society (Super and Harkness 1986). Several studies (Bird-David 2008; Briggs 1970; Guemple 1988; Musharbash 2011; Naveh 2016; Stern 1999) suggest that many forager parents view social sense as naturally developing in children as they grow, without much intervention from adults. Among the Inuit, for example, Briggs (1970, 1978) argues that growing up is a process of acquiring *ihuma,* a type of intelligence that relates to participating in the social world. Inuit parents further believe that there is little point in trying to teach a child before he or she demonstrates having *ihuma.* Similarly, among the Nayaka, growing up involves developing *budi,* or the skill of living together with others, which is not taught by parents. Among the Walpiri in Australia, young children are placed in the same category as angry people, referred to as *ramarama,* because anger is considered an unsocialized behaviour, and because young children themselves have not yet become social actors (Musharbash 2011). Among the BaYaka, autonomous but coordinated polyphonic singing, ritual play, and a complex system of taboos named *Ekila* elicit curiosity about understanding the world, and about culturally sanctioned ways of organizing into groups. Yet though BaYaka adults consider these activities vital, they allow children to grow into participating on their own (Lewis 2016). As Eickelcamp (2017) puts it, among the Australian Anangu adults believe that allowing a child to act autonomously gives him or her the chance to grow into who the child really is.

Social learning, individual learning, teaching and autonomy

Like other animals, humans learn both individually, through trial and error, and socially, by learning behaviours from others. Individual learning allows a single person to generate novel solutions to issues he or she faces, including problems related to life in a particular environment (Aoki et al. 2012; Boyd et al. 2011; Enquist et al. 2007). But individual learning is costly – it can take many trials to find an innovation that solves a particular problem. Social learning, on the other hand, is cheap, because no experimentation is required. However, a particular socially learned behaviour could, potentially, become maladapted in a changing world. Let's say, for example, that the climate in a hypothetical area has become hotter and drier in recent years, placing stress on berry crops that, through social learning, children learn to harvest with a tool that damages the plants. There have always been plenty of berry plants in the past, so this method was appropriate. Social learning, in this example, is passing on knowledge that is maladaptive to the current situation, and would need to be altered through the innovation of new picking practices to maintain a sustainable berry harvest.

While humans are not the only animal to learn socially, teaching among humans facilitates the transmission of especially complex skills that allow us to survive in nearly every environment on the planet. This chapter defines teaching following Hewlett & Roulette (2016; see also Boyette & Hewlett 2017a; 2017b) as (1) the modification of a behaviour by a teacher in order to enhance a learner's knowledge acquisition; (2) not the by-product of another activity; and (3) involving sensitivity between the teacher and learner. Teaching does not necessarily involve direct instruction (Kline 2015). Because much of human culture and technology is opaque in meaning and function, teaching allows a teacher to signal to a naïve learner that something is worth learning. This removes the cost associated with a naïve learner observing and individually deciphering which cultural behaviours are adaptive and which are incidental (Gergely & Csibra 2006). Though teaching increases the fidelity of information transfer, it may also restrict the development of autonomous exploration in children by having expert knowledge holders in a society and ossifying certain behaviours over other, equally adaptable ones. For example, Bonawitz and colleagues (2011, 2012) show in an experimental setting that American preschoolers were less likely to discover the various ways a puzzle toy could be solved when adults instructed children by demonstrating a single solution to the puzzle. When children were offered the opportunity to play with the toy without being taught how to use it, on the other hand, they took longer to learn how to use the toy, but they also discovered a greater variety of solutions.

Among egalitarian foragers, direct adult intervention in children's learning, such as instruction or chore assignment, is uncommon thanks to the parental emphasis on childhood autonomy discussed above (e.g., Boyette 2016a; Christian & Gardner 1977; Naveh 2014). Among the San (Draper 1976; Draper & Cashdan 1988), Matsigenka (Johnson 2003), Dene (Christian & Gardner 1977), Nayaka (Naveh 2014), Batek (Lye 1997) and Yukaghir (Willerslev 2007), adults actively refrain from instructing, directing, or correcting children, valuing instead firsthand knowledge gained by children through personal experience. This includes cases where children engage in dangerous activities. For example, Aka toddlers play with machetes and undertake dangerous games without adult interference (Hewlett et al. 2011). However, adult-to-child teaching does occur in a multitude of subtle ways that do not interfere with autonomy (Boyette & Hewlett 2017a, 2017b; Garfield et al. 2016; Lew-Levy et al. 2017, 2018). For example, an adult could simply turn his or her body so that children could more easily see the trap he or she is making. Such an action provides children the opportunity to learn without forcing them to do so. Direct instruction, on the other hand, would entail an adult specifically telling children how to make a trap. The former frequently happens among egalitarian foragers, while the latter rarely does.

Child-to-child teaching may be another way autonomy is maintained among egalitarian foragers. Indeed, Lew-Levy et al. (2020) find that child-to-child teaching is more common than adult-to-child teaching among BaYaka and Hadza foragers. Cross-culturally, much of this teaching often occurs in the playgroup (Fig. 2.1), where children acquire various skills, including hunting (Crittenden 2016a; Hewlett et al. 2011; Imamura 2016; Imamura & Akiyama 2016; Thompson 2003), trapping (Imamura 2106; Imamura & Akiyama 2016), the identification of edible plants, landscape navigation, and the construction and use of complex tools (Gallois et al. 2015; Imamura 2016; Imamura & Akiyama 2016; Thompson 2003). For example, Imamura (2016) and Imamura & Akiyama (2016) note that older San children correct younger children's tool manufacture. Child-specific foraging activities are also transmitted in the playgroup; Crittenden (2016a) shows that only Hadza children, and not adults, harvest weaverbirds using a sticky trap, a skill they teach other children. Learning skills like these from peers rather than adults allows for more accurate information transfer while also supporting a child's autonomy.

Autonomous learning through observation, participation and play

Children in all cultures learn through observation. But observation is particularly important for learning among egalitarian forager children thanks to the relative rarity of direct instruction and the potential for constant observation within small camps (Draper 1976; Fouts et al. 2016; Gaskins & Paradise 2009; Hewlett et al. 2011; Hewlett et al. 2019; Lye 1997; Odden & Rochat 2004). For example, Morelli et al. (2003) show that Efe two- to three-year-olds spend a quarter of their time observing work. Similarly, Neuwelt-Truntzer (1981) notes that Aka children spend much of their time watching adults. Nayaka children primarily learn to set traps through observation (Naveh 2014), and Jenu Keruba adolescents learn to collect honey by following adults (Demps et al. 2012; see also Boyette 2013; Burgesse 1944; Draper 1976; Flannery 1953; Harris 1980; Imamura & Akiyama 2016; Ohmagari & Berkes 1997; Tonkinson 1978; Vanstone 1965).

Beyond observation, children also learn through self-initiated participation in adult activities, allowing them to develop relevant competencies alongside adults (Gaskins 2000; Lancy 2012; Rogoff et al. 2003).

Figure 2.1. *BaYaka playgroups tend to consist of a broad range of ages and genders, typical of small, mobile forager bands. Photograph by Sarah M. Pope.*

Participation can occur in the form of helping behaviour, like fetching water and firewood among the Baka (Gallois et al. 2015), or hunting and trapping among the Cree and Chabu (Dira & Hewlett 2016; Ohmagari & Berkes 1997). However, children sometimes get in the way of adults. Draper & Cashdan (1988), for example, argue that nut cracking is more efficiently done by San adults, making child participation difficult. In these circumstances, children have two options. They can demand to participate, or they can choose to perform the activity without adults. Demand cooperation, which Sonoda (2016a, 2016b), Boyette & Hewlett (2017b) and Boyette & Lew-Levy (under review) note among BaYaka foragers, is similar to demand sharing in that children insist that others share knowledge, time, or space. Resisting such demands would violate the ethos of sharing, which is important among many foragers, and thus adults often comply with these demands.

When children cannot proficiently perform a given activity, they often practice through play. As children grow, play that emulates specific, complex adult activities becomes less frequent, while participation in these same activities becomes more common (Bock and Johnson 2004). Thus it may be that play allows children to autonomously practice activities that are too complex or too dangerous to learn through work. The tradeoff between play and work is also documented among the Aka (Boyette 2016a; Lew-Levy & Boyette 2018) and Baka (Gallois et al. 2015). Importantly, much of the play ethnographers note among a wide cross-cultural sample including BaYaka (Lewis 2002; Lew-Levy et al. 2019), Hadza (Crittenden 2016a; Lew-Levy et al. 2019), San (Shostak 1976), Kaytetye (Thompson 2003), Aka (Neuwelt-Truntzer 1981), Mardudjara (Tonkinson 1978), Pitjantjatjara (Ilyatjari 1991), Chipewyan (Vanstone 1965) and Gros Ventre (Flannery 1953) involves the imitation of adult activities. Building small shelters and hearths is particularly ubiquitous among the world's foraging children. Near these shelters, children intermittently dig tubers, hunt, gather, or play at these same activities (e.g., Crittenden 2016a). Thus, for foragers, the movement from play to work makes participating in work 'just as rewarding as pretending' once a child has the relevant skills (Crittenden 2016a; Lew-Levy & Boyette 2018).

Autonomy and children's learning of gendered behaviours

As with all skills, forager children in autonomous-learning contexts primarily learn gendered behaviours through observation, imitation and play, not through direct instruction or chore assignment (Lew-Levy et al. 2017). Hunter-gatherers generally maintain a division of labour that encourages men and women to target different resources, which diversifies their economic capabilities and mitigates potential foraging failure (Marlowe 2007). The division of labour also facilitates cooperation between men and women, and when centred on a foundation of autonomy for both genders, it can facilitate relative gender equality (Marlowe 2007). However, true egalitarianism between men and women, in terms of equal maintenance of authority, is rare (Kelly 2013).

How, then, do children in autonomous-learning contexts develop an understanding of gendered behaviours and the roles of men and women? Boys and girls in small forager camps play and learn together, and both tend to spend similar proportions of their time in play and work (e.g., Blurton Jones & Konner 1973; Draper & Cashdan 1988; Hewlett & Hewlett 2012; Marlowe 2010; Morelli 1997). Amongst the San, for example, Draper & Cashdan (1988) find no differences between boys and girls in rates of rough-and-tumble play, and Blurton Jones & Konner (1973) find few significant differences in gendered play more broadly. Among the Batek (Endicott & Endicott 2008; Lye 1997) and Chipewyan (Vanstone 1965), and in Arnhem Land (Cowlishaw 1982), boys and girls engage in the same activities until the age of ten or twelve. In addition, in comparisons of Efe foragers and Lese farmers, Aka foragers and Ngandu farmers, San foragers and British school children, and BaYaka and Hadza children, Morelli (1997), Boyette (2016a), Blurton Jones and Konner (1973) and Lew-Levy et al. (2019) find few differences in play and work behaviour between male and female forager children, while gendered differences are apparent among the non-forager groups.

Importantly, among egalitarian forager children, the division of labour between genders tends to be flexible, and girls may not be punished for undertaking traditionally male activities, or vice versa. For example, Batek girls will sometimes hunt squirrels with blowguns (Endicott & Endicott 2008). Similarly, Nisa, a San woman, describes being congratulated by her male adolescent peers for successfully running down a Kudu (Shostak, 1976, 1981). And, among the Eveny, Ulturgasheva (2012) describes a young girl whose parents raised her to tend reindeer, a male-typical activity. Gallois et al. (2015: 11) note that for Baka children, 'while some activities are clearly gender-oriented, there are no strict gender exclusions in the performance of most activities'.

By middle childhood, however, forager boys and girls begin to exhibit differences in travel ranges and participation in work tasks. Among the San, girls remain closer to home than boys, while boys are more likely to participate in antagonistic behaviour (Blurton Jones & Konner 1973; Draper 1975). Among the Baka, girls of seven and older participate in more child minding, cooking, and fishing than boys, while boys participate in hunting (Gallois et al. 2015). It should come as no surprise that these economic activities follow a gendered division of labour in adulthood. It is important to note, however, that adolescents in general, and girls in particular, rarely participate in chores because they are forced to do so (Boyette & Lew-Levy, under review). Instead, teenagers generally engage in economic activities by their own volition, by identifying with adults of their same gender and imitating their behaviour (Draper 1975; Endicott & Endicott 2008; Flannery 1953; Gallois et al. 2015; Hewlett & Cavalli-Sforza 1986; Hewlett & Hewlett 2012; Lew-Levy & Boyette 2018; Lew-Levy et al. 2019; Neuwelt-Truntzer 1981; Pandya 1992; Wallace & Hoebel 1952).

Gendered chore assignment and increased gender inequality

The idea that cultural inequality begins with intensifying gender inequality, and that gender inequality begins with intensifying women's labour, is prominent in the literature (e.g., Arnold 1993; Collier 1988; Hayden et al. 1986). And issues of gender equality return, ultimately, to the question of autonomy. In any particular system, how much autonomy does a woman have? If instructed to marry a particular person, for example, can a woman say no, and be supported by the culture surrounding her? Even among the San, who are mobile and broadly egalitarian, a woman named Nisa only succeeded in her refusal to marry the first man chosen for her by asserting herself vociferously and repeatedly (Shostak 1981). This suggests imperfect gender egalitarianism among the San, but Nisa ultimately did have enough community-sanctioned autonomy to assert her will. So what causes the autonomy of girls like Nisa to erode, even in otherwise relatively egalitarian societies? Hayden et al. (1986) argue in a cross-cultural survey of 33 forager cultures that women's status is lowest in areas including domestic, ritual and political affairs when resource stress is highest. In writing about North American Plains societies like the Comanche and the Kiowa, Collier (1988) argues that marriage is a vital method for men to acquire alliances and labour. Also working with Plains people, Arnold (1993) argues that men use marriage, women's work, and the connections through their wives to sons-in-law, brothers-in-law, and other women to create a labour pool that subordinates others. How people organize marriage, then, and how much say a woman has over her marriage, often determines how much inequality exists between men and women. However, no studies to date have considered the relationship between general cultural inequality and the intensification of female children's labour.

Cross-culturally, researchers argue that children are assigned more chores as egalitarian foragers become more settled (e.g., Draper & Cashdan 1988). This may be partially because children are more productive in settled communities, as the chores and tasks affiliated with settled life are more appropriate for children's labour (Lancaster & Lancaster 1987; Wenke 1990: 237). In addition, Munroe et al. (1983) argue that horticultural and agricultural cultures must invest significantly more energy than foragers in chores to maintain their numerous possessions, including land, dwellings, and animals. Amongst small-scale horticultural or agricultural societies, children undertake chores including food processing, cleaning, carrying water, feeding animals, weeding and harvesting (Bock 2002; Kramer 2002; Munroe et al. 1983; Whiting & Edwards 1988; Whiting & Whiting 1975). Several authors argue this transition toward increased work for children is because such chores are not particularly demanding in terms of skill or strength, and do not require extended training (Bock 2002; Hames & Draper 2004; Kramer 2002). In contrast, foragers use resources that are relatively distant, not managed, and not predictable, making children's participation in this work far more difficult (Hames & Draper 2004). That is not to say that forager children never help with provisioning or economic work. Indeed, labour varies in both the short and long term among both settled and mobile peoples (Blurton Jones et al. 1997; Bock 2002; Munroe et al. 1984). For foragers, children's contributions depend on a multitude of factors, including their environment. For example, Hadza children are known for their extensive foraging, while San children rarely forage, likely due to differences in the degree to which children can safely navigate the bush without adults (e.g., Blurton Jones et al. 1997). However, even when forager children frequently work, they generally do so under their own volition and less intensively than agricultural children (Blurton Jones et al. 1994; Konner 2016).

More specifically, among settled peoples cross-culturally girls are assigned disproportionately more chores than boys, and at a younger age (Bloch & Adler 1994; Condon & Stern 1993; Draper & Cashdan 1998; Morelli 1997; Munroe et al. 1984). In addition, their chores are foundationally different from those assigned to boys. Girls tend to be assigned housework and other chores close to adults, meaning they are frequently reassigned (Condon & Stern 1993; Morelli 1997; Whiting & Edwards 1973). Their work also appears to be of longer daily duration, and to continue for more years than it does for boys (Barry et al. 1957, 1959; Ember 1973: 426, 1981: 540, 555; Nag 1962, Nag et al. 1978; Whiting & Edwards 1988: 177–82). Sibling caretaking is particularly gendered in these contexts, and cross-cultural sources report again and again that girls are recruited into childcare roles earlier and far more frequently than boys (Hames 1988; Hames & Draper 2004). Boys, on the other hand, might be sent to mind livestock or gather firewood, offering them greater freedom (e.g., Draper & Cashdan 1988). In contrast, amongst more mobile foragers, if children are asked to help with economic duties, adults are less likely to differentiate their requests between boys and girls (Morelli 1997). Yet even among the broadly egalitarian Hadza, Kaplan et al. (2000: 159) argue that young women are economically independent from other adults and capable of completely providing for themselves by age 15, while young men are not comparably independent until age 20. These data suggest that the earlier transition to work that girls experience among settled small-scale societies may be an amplification of a trend that already exists among mobile foragers (Boyette 2016a).

Broadly, a variety of authors argue that assigning children gender-specific tasks is a cross-culturally important precursor to the development of more rigid gender roles (Draper 1985; Draper & Cashdan 1988; Ember 1973; Quinn 1977). When comparing mobile and settled San, Draper & Cashdan (1988: 359) note that the behaviour of settled San children 'had changed in the direction that begins to approximate that of children in societies with longer traditions of settled food production, sex-role differentiation and peer-rearing'. Beyond economic activities, children also showed marked differences in other behaviours. For example, mobile San children showed no gendered differences in rough and tumble play, while sedentary

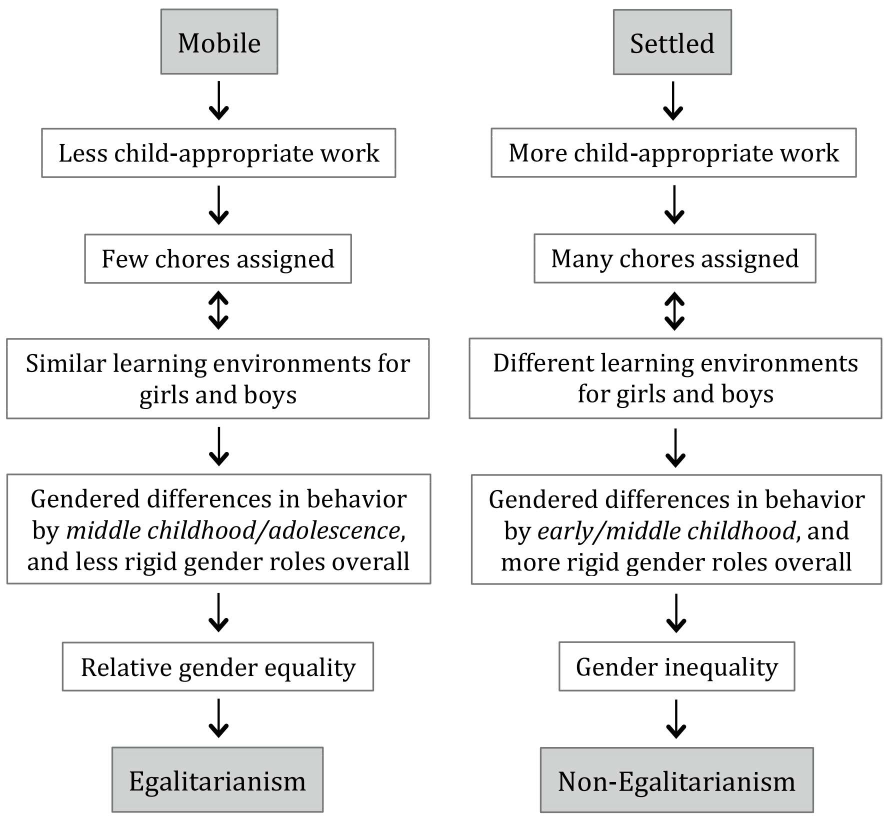

Figure 2.2. *Flowchart of the potential relationship between relative mobility, chore assignment, gendered learning environments and egalitarian or non-egalitarian social structures.*

San boys were more likely than girls to participate in rough and tumble play. Among settled San (Draper 1975), Inuit (Condon & Stern 1993) and in Arnhem Land (Cowlinshaw 1982), children of any gender were not only more readily assigned chores, they also had clear ideas as to the nature of gender differences by adolescence. Indeed, they were shamed for engaging in a non-gender-conforming fashion, including ignoring chores.

Overall, the cross-cultural evidence synthesized here argues that autonomous learning decreases among many forager groups when they become less mobile, while gendered chore assignment increases. In other words, when mobility decreases, gender inequality increases thanks partially to increased gendered regimes of chore assignment for children. Figure 2.2 shows a graphic version of processes that may reinforce increased gender equality among mobile foragers, and decreased gender equality as foragers become more settled. To better understand the relationships between the various steps in these simplified flow-charts, we need more cross-cultural data on the transition from play to work of boys and girls in forager groups of varying mobility. Right now, we are noting a correlation and not necessarily a causation. In addition, we need data considering how decreasing mobility impacts not only what girls and boys do, but how parents and children perceive those changes.

Mixed-age playgroups, same-age playgroups and competitive behaviour

An ethos of competition does not spontaneously occur in adulthood, but is learned socially throughout a child's life (e.g., Bandura et al. 1961; Fry 1990). In the ethnographic literature, it is clear that competition is at the heart of non-egalitarian forager societies (e.g., Hayden 1994; Keeley 1988; Kelly 2013; Smith & Choi 2007). For some people to hold prestige over others, they or their ancestors must have competed effectively for control over important resources, and those with prestige must continue to effectively compete to maintain their status and property (Kelly 2013). In this system initially, individuals have to choose to relinquish their autonomy to a leader in return for some perceived benefit (Riches 1984). Perhaps that benefit is specialized knowledge, or spiritual power, or in-group protection from others. Among many non-egalitarian foragers, prestige may be given to a leader in order to coordinate communal labour and manage free-riders (Eerkens 2012). Large-scale competitive feasting or gift-giving becomes common in many of these cultures, but they also often foster smaller-scale day-to-day competitive behaviours (Sanday 1981). The potlatch is an excellent example of conspicuous competitive behaviour among non-egalitarian foragers; on the Northwest Coast of North America, forager peoples like the Kwakwak'awakw, Tlingit and Haida undertake extensive prestige gift-giving, competing to exchange the most elaborate and valuable gifts (Coupland 1985; Drucker & Heizer 1967). Cross-culturally, this kind of competitive behaviour is linked to increased gender segregation and inequality, as well. In a study of more than 150 'tribal' societies, Sanday (1981) makes the connection between a cultural endorsement of competition and the segregation of men and women in work and childcare. In general, as people (particularly men) come to see competition and controlling other people's labour as 'the primary way of achieving goals', inequality continues to grow (Kelly 2013: 266).

More broadly, the idea that children in WEIRD (Western, Educated, Industrialized, Rich and Democratic) societies are more competitive than children in other cultures has seen significant research in psychology in particular (e.g., Kagan & Madsen 1971; Madsen 1971; Miller & Thomas 1972; Shapira & Madsen 1969). These studies suggest that an increase in competitive games and behaviours among children does not only occur in the transition from mobile groups to settled, but also if cultures become more urbanized, or more integrated into WEIRD societies. When comparing children from various Mexican cultures with Euro-American children, for example, or kibbutz and urban children in Israel, Madsen (1971), Kagan & Madsen (1971) and Shapira & Madsen (1969) find that the Euro-American children and urban children exhibit consistently more competitive behaviour. Miller and Thomas (1972) find similar patterns among Blackfoot children, who cooperated effectively much more consistently than urban Canadian children. Miller's (1973) study in an integrated school, however, finds that integrated teams of Blackfoot and non-Indian students exhibited rates of cooperation midway between those of Blackfoot students at non-integrated schools and urban Canadian children alone. Work with Australian Aboriginal children has similar results, suggesting increased competitive behaviour correlates with increased integration into WEIRD societies (Sommerlad & Bellingham 1972).

Among egalitarian forager groups, children spend a great deal of their time in mixed-age and gender playgroups, learning from one another and playing at adult activities (Boyette 2013, 2016a; Endicott & Endicott 2008; Konner 1976, 2005; Lew-Levy et al. 2019; Turnbull 1978). In these small groups, there are generally not enough children to form an entire playgroup of 10 to 12 year-olds, for example, or five to seven year-olds. Playgroups, therefore, will often consist of children of any gender, ranging in age from toddlers to adolescents (Figure 2.1). Indeed, Konner (1976; 2005) argues that, in an average San camp, the chance of an individual having one agemate on his or her first birthday is approximately 88 per cent given infant mortality, while the odds of the same child having even as few as three peers is just 5.4 per cent. There simply are not enough children born in very small groups to allow each child to have multiple age-mates.

As a result, the mixed-age playgroup creates an environment where playing competitive games is unsatisfying and not culturally appropriate, and therefore uncommon. As Draper (1976) writes of the San:

> *The limited and heterogeneous assortment of playmates available to a child poses interesting constraints on the kind of games which children can play […] To compete in a game or skill one needs one or preferably more children close in age and perhaps sex with whom to compete, but the smallness of group size among !Kung usually ensures that several age-mates are not available. Team sports are similarly unrealistic. Not only can the children not fill out a team; but the players are at such different levels of motor skill, motivation, and cognitive development that it is difficult and unrewarding to play a game involving intense competition, rules, and fairly complex strategy.*

Endicott & Endicott (2014) and Lewis (2002) agree that games in mixed-age playgroups among the Batek and BaYaka are generally non-competitive. Aside from the issue of having age-mates with whom to play, Boyette (2016a) also argues that, if we expect play to create and reinforce culturally relevant behaviours, it should be unsurprising that competition is infrequently employed in broadly egalitarian cultures, where dominance, ranking of people and strict adherence to rules are de-emphasized (Boyette 2016a; Turnbull 1978). Nor do children have models among older children or adults from whom to learn competitive games. This does not mean that children's games cannot be fiercely contested, or that people do not notice an individual's particular skill. In addition, mixed-age and sibling playgroups are hardly without conflict. As Weisner (1984: 348) notes of the San, 'fierce feuds, bitterness, and competition can characterize sibling relationships in childhood and adulthood. Teasing, benign neglect and the domination by older children of younger ones are frequent'.

On the other hand, when foragers become less mobile and live in larger groups, same-age playgroups, and gender-specific playgroups, become much more common (Lew-Levy et al. 2019). And, in turn, competitive games can become more interesting and more rewarding to undertake. Cross-culturally, Whiting & Edwards (1988) demonstrate that same-age playgroups tend to be more competitive than mixed-age playgroups. Lancy (1984, 2001) argues that children in mixed-age playgroups will play 'simpler' games than same-age playgroups. In a sample of seven small-scale Papua New Guinean societies, Lancy (1984) finds that children's games are limited by the younger members of mixed-age playgroups, meaning that the games they played were things like tag or target-shooting – games that could be played by children as young as four. In contrast, same-age playgroups among larger populations can play games with complex, age-appropriate rules, and even keep score.

The foregoing cross-cultural observations suggest that increased competitive play among children in less mobile cultures who live in larger groups contributes to a generally competitive ethos that fosters inequality. Another shift in competition and cooperation may occur between relatively small-scale settled societies and WEIRD societies, as demonstrated in research comparing rates of cooperation between Mexican farmers, Blackfeet, Australian Aboriginal children and children from WEIRD societies (Kagan & Madsen 1971; Madsen 1971; Miller 1973; Miller & Thomas 1972; Shapira & Madsen 1969; Sommerlad & Bellingham 1972). This research suggests that an emphasis on competition may begin with larger playgroups, but it appears to intensify with industrialization. Figure 2.3 demonstrates the theoretical relationship between multi-age playgroups and egalitarianism, and same-age playgroups and non-egalitarianism. However, we do not know whether there is a causal relationship between the tendency toward more competitive games among settled, formerly mobile forager children and

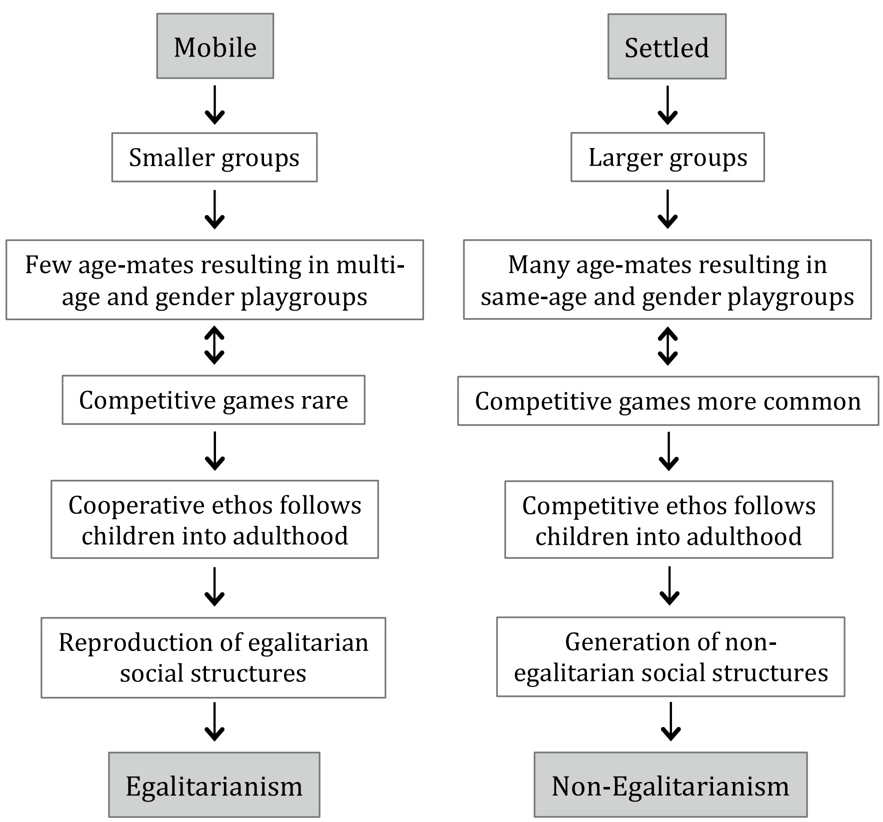

Figure 2.3. *Flowchart of the potential relationship between relative mobility, the composition of children's playgroups, competitive games, and egalitarian or non-egalitarian social structures.*

a more competitive ethos in adulthood. If children spend their childhoods playing games where there are clear winners and losers, where obvious leaders emerge, does that make them more likely to look for and then follow leaders in adulthood? Importantly, we also do not have good data on whether children from formerly mobile groups innovate competitive games in same-age and gender playgroups, or whether they merely adopt games from new neighbours. In addition, research into whether increased rates of competitive play in small-scale societies correlate with increased wealth disparities would help to elucidate whether there is, indeed, a relationship between increased inequality and competitive play.

Conclusions

In sum, children in mobile, broadly egalitarian hunter-gatherer cultures are 'active learners who participate in learning by choice, and for whom learning is an ongoing, playful activity, not separated from the rest of life' (Lew-Levy et al. 2017: 386). As we have seen, these children lead autonomous lives; they participate in work and play at will, usually within a roving playgroup of mixed-age, mixed-gender children. They receive very little intervention, in the form of chore assignment or teaching, from adults. Children and adults consistently share space (Hewlett et al. 2019), which allows children to observe and participate in adult activities. Individuals can demand to participate in adult activities, just like they can demand for food to be shared with them. In so doing, children (and adults) ensure the free flow of information, as they do with goods and food. Finally, adults are not considered the primary holders and transmitters of knowledge. Children learn together, and from each other, within the playgroup. Given the importance of autonomy and of child-to-child learning within the playgroup, it makes sense that increasingly gendered chore assignment, changes to playgroup membership and increased competition between children would be linked to broader cultural changes and increased inequality. This chapter argues that current cross-cultural data supports a connection between changes to children's learning processes and increased inequality, but direct data demonstrating the causal links suggested here do not yet exist. Nonetheless, this chapter highlights the importance of taking children seriously when considering social transformation in the present, and in the past. Modern psychology and anthropology consider children active agents in their own development, and archaeologists must also acknowledge them as active agents in cultural transmission and change.

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Chapter 3

The impact of equality in residential decision making on group composition, cooperation and cultural exchange

Mark Dyble

One of the most conspicuous features of hunter-gatherer life is mobility – hunter-gatherers 'move around a lot' (Lee & DeVore 1968: 11). Of course, some groups and some individuals within these groups move more frequently than others. In many cases, the ability of individuals or groups to move freely is an important manifestation of equality. The aim of this chapter is not to provide a comprehensive survey of residential flexibility in contemporary hunter-gatherers, or to argue that any one residential system was likely to have been dominant among humans before farming. Rather, I start from the assumption that pre-Holocene hunter-gatherers will have varied in their residential systems and instead explore the *consequences* that this variation may have had on other aspects of life. Specifically, I focus on three topics that have recently received much attention in evolutionary anthropology: social organization, cooperation, and cultural exchange.

Residential flexibility

Much investigation of residential flexibility in foraging societies has, rightly, focused on its spatial and temporal components and their ecological determinants (e.g. Kelly 1983). Here, however, I focus solely on the *social* dimension of residential flexibility – the extent to which individuals, families, or sub-groups can move from living with one collection of individuals to living with another. The archetypal flexible system of residence is, arguably, the Hadza. As described by Woodburn (1968) in *Man the Hunter*, Hadza camps are 'open, flexible, and highly variable in composition' (p. 103) and a Hadza man or woman may 'live, hunt, and gather anywhere he or she likes without any sort of restriction and without asking permission from anyone' (p. 105). The only exceptions are the tendency for a husband and wife to live together and for them to co-reside with the wife's mother more frequently than with the husband's mother (see also Marlowe 2004).

Many small-scale hunter-gatherers have systems similar to that of the Hadza but with some additional restrictions on where individuals may reside. For example, while the Mbuti have a social system characterized by a high degree of fission-fusion 'flux' (Turnbull 1968), movement is restricted within a bounded territorial unit. Among the Agta, while 'flexibility and fluidity is the rule' (Griffin 1984: 105), individuals are limited to joining camps containing kin. According to Griffin (1984: 105) 'No Agta couple would willingly sleep a single night among non-kin'. This is reflected in the quantitative data on the Agta collected by myself, Daniel Smith, Abigail Page, and Andrea Migliano in 2013 and 2014. We found that only seven of 279 adults (2.5 per cent) were residing in camps containing neither consanguineal or affinal kin, despite living in camps containing a large proportion of unrelated individuals (Dyble et al. 2015).

However, just as kinship may constrain social relations, it may also facilitate them. Among the Ju/'hoansi, personal names are drawn from a very limited number of sex-specific options. Richard Lee (1993) lists 35 male and 32 female names in use among the Ju/'hoansi in 1964. While drawing from a limited pool of names does make it difficult to refer to a specific person using only their name, the Ju/'hoansi use the high frequency of name matches to open up a complex secondary world of kinship relations in which anyone with the same name as your close kin can be referred to using this kinship term. For example, anyone with the same name as your father will be referred to as your father and they will, accordingly, refer to you as their son or daughter. These 'kinship II' ties, as Lee describes them, facilitate friendly relations with people in distant groups, making 'close kin out of distant strangers' (Lee 1993: 74). Even though individuals are still aware of the difference between their 'true' genealogical kin and these fictive kin, cultural practices such as this (and the *Hxaro* exchange system, also among the Ju/'hoansi (Wiessner 1977)) may serve to ease the process of new individuals visiting or joining other groups. More broadly, recognition of linguistic or cultural cues of wider group membership may also facilitate relations beyond the band.

Although there are many dimensions to hunter-gatherer residence practices, the extent to which residential rules favour the movement of men versus the movement of women has perhaps attracted the most attention. Groups may be matrilocal (related terms include uxorilocal or female philopatric) if men leave their natal group upon marriage, patrilocal (or virilocal or male philopatric) if women leave to marry, or bilocal if either sex may leave. Of course, such terms implicitly assume a certain degree of sedentism, such that individuals can 'leave' or 'stay' (Marlowe 2004). It also assumes that young households distribute themselves relative to older households. In reality the opposite may be true, with older households moving to live with their grandchildren. Where a married couple can live with either family and where they will frequently move throughout life, the term multilocality has been used (Ember & Ember 1972; Marlowe 2004). Looking across a sample of 32 hunter-gatherer societies for which quantitative data on the residence structure of bands are available, Hill and colleagues (2011) suggest that a multilocal system is typical, with mixed-sex siblings frequently co-residing. This tendency in hunter-gatherers toward the kind of flexible residence described above is also reflected in the cross-cultural analyses compiled by Marlowe (2004) and Alvarez (2004).

What are the consequences of residential flexibility?

The argument that mobility is a core feature of hunter-gatherer life is an old one. Mobility, at the very least in the form of daily forays, is a requirement of foraging, is associated with a lack of easily defensible resources, interrupts the accumulation of material wealth, and allows the distribution of men and women and old and young across camps, associations that have been discussed at length elsewhere (e.g. Binford 1980; Dyson-Hudson et al. 1978; Kelly 2013; Sahlins 1973; Venkataraman et al. 2017). Mobility has also been argued to be reflected in the ideologies and oral traditions of many hunter-gatherer groups (Mauss & Beuchat 1906; Sahlins 1973; Smith et al. 2017). The aim of the rest of this chapter is to examine some less immediately obvious consequences of residential flexibility that may have important implications for human social evolution – cooperation, cultural exchange, and group composition.

Residential flexibility and cooperation

Thinking broadly about the factors that promote cooperation, both across human societies and the natural world more generally, we have good reason to expect that residential flexibility might erode cooperation. Many of the basic evolutionary explanations for altruism rely on individuals being able to recognize others and to cooperate with them according to their behaviour in previous interactions – anonymity is anathema to models of cooperation that rely on reciprocity. Where individuals can freely leave groups and join new ones they can escape punishment, shake off their poor reputations, and inflict themselves on strangers (Boyd & Richerson 1988; Eshel & Cavalli-Sforza 1982; Ohtsuki et al. 2006). Experimental games played among Agta communities of varying degrees of residential turnover provide some support for this general prediction, with individuals from camps of more stable composition behaving more generously toward group mates in two economic games (Smith et al. 2016).

In other ways, however, highly flexible residence may *favour* cooperation. Firstly, flexibility allows individuals to 'vote with their feet', moving away from tyrannical or uncooperative group mates. This may both allow the avoidance of arguments or violence, as suggested by Turnbull (1968) for the Mbuti, but also facilitate cooperation by isolating free-riders. Computational modelling has suggested that the simple process of individuals leaving a group when it becomes sufficiently unproductive due to free-riding group-mates could sustain the evolution of cooperation in food sharing, even in the absence of punishment (Lewis et al. 2014). Experimental games of cooperation played among the Hadza may provide support for this idea, with more cooperative individuals positively assorting (Apicella et al. 2012), although recent work suggests that this finding may be a consequence of the establishment of prosocial norms within groups, rather than of intrinsically more cooperative individuals assorting (Smith et al. 2018). If we think broadly about human social evolution, it is clear that we are capable of cooperation 'the hard way', that is through the establishment of social norms, reputation that transcends one's immediate group, linguistic and social cues of group membership, as well as through simpler mechanisms of kin nepotism, and reciprocity (Gurven 2004; Lewis et al. 2014). It seems likely that our ability to cooperate through complex social relationships is an adaptation to interacting with a large number of relatively unrelated individuals (Dunbar 1998; Lukas & Clutton-Brock 2018).

Residential flexibility and cultural exchange

A growing body of research suggests that the human capacity for acquiring and transmitting cultural knowledge has as much to do with our social organization as it does with our cognition (Derex & Boyd 2015; Henrich 2016). In particular, it has been suggested that the rate of cumulative cultural evolution may be determined, in large part, by population size (Henrich 2004; Powell et al. 2009). This demographic effect has a simple basis – from an individual's point of view, the more individuals you meet and share ideas with, the more likely you are to learn of an innovation. All else being equal, innovations are more likely to be made in larger groups, and are more likely to be transmitted in better connected ones. Apparent bursts of cultural complexity, as in the European Upper Palaeolithic, or African Middle Stone Age, have thus been hypothetically attributed to demographic drivers (Powell et al. 2009), as have the loss of cultural or technological repertoires (Henrich 2004).

However, the empirical evidence from ethnographic studies for the role of population size in driving complexity is mixed (Collard et al. 2013, 2016; Vaesen et al. 2016). The demographic hypothesis also raises the question of how hunter-gatherers, living in small, low-density populations, have been so successful in developing cultural and technological adaptations to a vast range of environments. The answer almost certainly lies in the fact that small-scale hunter-gatherers frequently live in fluid sub-groups of a much larger multilevel social organization. This system has been argued to be a fundamental feature of human sociality (Chapais 2011; Grueter et al. 2012; Layton et al. 2012) and one that may play an important role in facilitating cooperation in small-scale societies (Dyble et al. 2016; Koster 2018; Salali et al. 2016). Critically, being part of a meta-group allows individuals to meet (and exchange ideas) with many times more individuals than they live with at any one time. Among the Ache, it is estimated that men observe more than 300 other men making tools during their lifetime, 15 times more same-sex conspecifics than male chimpanzees are estimated to meet in a lifetime, despite the average size of Ache bands being similar to that of chimpanzee groups (Hill et al. 2014). Data on social interactions within Agta and Mbendjele BaYaka camps also suggest that the social structure seen within bands (strong bonds within households with kinship and friendship ties between them) may facilitate efficient cultural transmission (Migliano et al. 2017). In fact, in a recent twist on the demographic argument, it has been suggested that living in sub-groups within larger meta-groups may actually be advantageous compared to living in larger and better-connected group in terms of cultural evolution – experimental evidence has suggested that 'partially connected' populations may develop more diverse solutions to problems that, when combined, allow for complexity that would not have otherwise emerged (Derex & Boyd 2016).

Finally, bilocal residence (where either sex may reside with kin) may have a particularly pronounced effect on the evolution of sex-specific cultural traits. The core of this idea is simple where sex-specific cultural traits are concerned – a man who is exposed to the cultural and technological repertoire of both his brothers and brothers-in-law, or a woman, of her sisters and sisters-in-law, will have a much broader of pool of cultural models to copy than an individual limited to learning from only their genetic kin. Indeed, if male-only traits are inherited vertically from father to son, or female-only ones from mother to daughter, then close consanguines are unlikely to be a source of novel cultural or technological ideas. Modelling suggests that female-biased dispersal can severely limit the cultural diversity of male-specific cultural traits, and that male-biased dispersal can limit the diversity of female-specific traits (Dyble 2018). Such an effect could potentially explain the female bias in cultural proficiency among chimpanzees and bonobos (Boesch & Boesch 1981; Pruetz et al. 2015), typically female-dispersing species (Gerloff et al. 1999; Goodall 1986),

Multi-locality and group composition

As well as being an important element of social organization in its own right, residential flexibility may have a significant impact on the kinship structure of groups. Modelling, supported by ethnographic data, suggests that multilocal residence can explain why the majority of co-resident adults in hunter-gatherer bands are unrelated through either consanguineal or close affinal ties (Hill et al. 2011; Dyble et al. 2015). This effect occurs because unilocal residence allows sets of same-sex siblings to form the core of a community (a 'band of brothers – or sisters' effect), whereas bilocality splits them up. In a strictly patrilocal system, a man will be living in a group consisting entirely of patrilineal consanguines and their spouses. In a bilocal system, a man could be living with far more distantly related individuals – his wife's brother's wife's sister's husband, for example. This reduces the proportion of co-resident adults who are related through affinal or consanguineal kinship ties as well as the average genetic relatedness of groups. To illustrate this effect, consider the relatedness within a group composed of four couples where one member of each couple must have at least one sibling in the group. If, as in a unilocal system, only same-sex siblings co-reside, this group may take only one form – a group of four same-sex siblings and their unrelated spouses (Fig. 3.1a). The mean relatedness in such a group is $r = 0.11$. Although

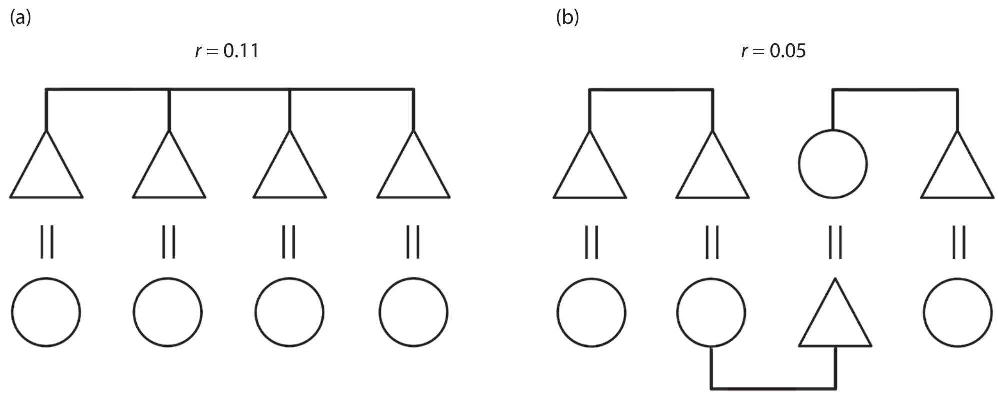

Figure 3.1. *Illustrative example of the possible effect of mixed-sibling co-residence on the relatedness of groups. Both panels show the minimum relatedness within a group composed of four couples, each of which must contain one individual with a sibling in the group. In panel (a) only same-sex siblings may co-reside. In panel (b) mixed-sex siblings may co-reside. Triangles represent men and circles represent women. Horizontal ties represent siblingship and double hyphens represent marriage;* r *is the mean coefficient of relatedness.*

a bilocal system where mixed-sex siblings may co-reside can achieve a similar structure to the unilocal scenario (i.e. a group of four mixed-sex siblings and their spouses), relatedness can also be much lower, with Figure 3.1b showing the minimum relatedness possible in such a scenario ($r = 0.05$).

Of course, if bilocal/multilocal residence reduces the average number of kin that individuals co-reside with, it must also increase the number of kin living outside their band. Might having a widely dispersed network of kin be advantageous? First, on a theoretical note, we should not always assume that living with kin is beneficial. Where kin compete with one another for resources but have little opportunity to cooperate, the best thing that many organisms can do for kin is to avoid them altogether (West et al. 2002, 2001). Given the energetic interdependence of humans, however, and the known importance of kin in small-scale societies, this may be unlikely to be the case for humans. A more likely benefit of having a widely dispersed network of kin is that this increases the number of other camps that an individual may join. Although groups such as the Hadza are said to have a completely open system of residence in which individuals may join any other camp, in many other hunter-gatherer groups, kinship ties are required to do so, as discussed above. In such a context, having a widely dispersed network of kin allows future access to many camps. This may be critical in allowing individuals to leave resource-depleted areas, to access a broader range of foraging sites, and to maintain social relationships.

To what extent does bilocal rather than unilocal residence actually increase the number of communities in which a household has kin with whom they can co-reside? On first consideration, the increase could be as much as fourfold: in a unilocal system, a household can live with the same-sex kin of either the husband or wife (according to the system; not both). In a bilocal system this is doubled twice – the household can live with *either* sex kin of *either* the husband or the wife. However, there will almost certainly be overlap in where these additional kin reside. How can we estimate the magnitude of the increase in kin distribution across camps promoted by bilocal residence? One possibility would be to compare the distribution of kin across camps in empirically observed hunter-gatherer groups with relatively bilocal versus unilocal residence systems. While doing so may have merits, the many ecological, cultural, and demographic differences between populations would likely obscure a straight comparison.

As an alternative, we can use computational simulations based on empirical data to generate hypothetical group compositions, given various sets of residential rules. This allows us to ask a series of '*what if*' questions while holding fundamental demographic aspects of kinship structure constant. For example, what would group composition look like if individuals were randomly sorted into camps? *What if* only women could dictate where their household moved? *What if* a small set of leaders determined where households could reside? Thinking in this way requires us to decouple our understanding of individual-level processes and group-level patterns – although our phenomenon of interest is the composition of a group, this is an emergent product of decisions made by individuals, albeit within the framework of culturally imposed norms, rules, and institutions.

Here, I use a simple computational simulation to explore how many different camps a household can reside in given various sets of rules concerning residence. These rules concern (*i*) whether one or both sexes within the household can influence where the household resides and (*ii*) the degree of kinship connection in another camp that is required for a household be permitted to join it. I explore the impact of these rules in computational simulations that use empirical data from Agta hunter-gatherer communities. The Agta are group of small-scale hunter-gatherers from northeastern Luzon, Philippines (Minter 2008; Rai 1990). As described above, the Agta have a bilocal system in which households regularly move, but where kinship ties are usually required to join an established camp. For the purposes of this computational model, however, the use of empirical data is to provide a reasonable hunter-gatherer demographic and kinship structure and it makes no specific comment on the Agta themselves. For description of the social organization of the Agta themselves, see Griffin (1984), Minter (2008) and the data contained in Dyble et al. (2015, 2016) and Migliano et al. (2017).

The simulation, written in the statistical software *R*, consists of an algorithm that sorts 120 married couples from a subset of the observed married adult Agta population (240 people in total) into 15 groups containing 8 couples each. From genealogical interviews, we have data on all genetic kinship ties between these 240 people. The sorting procedure of the algorithm places these 240 people into camps according to a set of selection criteria that approximate either a bilocal or a unilocal system of residence.

Sorting procedure

The simulation begins by taking one of the 120 couples and placing them in a camp. At this point there are two 'placed' individuals, and a pool of 238 'unplaced' individuals. Next, unplaced individuals who are related by kinship to one of the two existing camp members (according to the selection criteria described below) are identified. One of these individuals is randomly chosen to join the camp. This individual is joined by their spouse. We now have four individuals who have been placed in a camp and a pool of 236 unplaced individuals. In each turn, we repeat this process, choosing an individual from the unplaced pool and placing this individual and their spouse in the camp. This process continues until there are 8 couples (16 individuals) in the camp and is then repeated for every other camp until the 240 individuals have been placed into 15 camps of 16 individuals each. If no one from the pool of unplaced individuals is related to an existing camp member, a random individual from the pool and their spouse are chosen to join the camp.

Selection criteria

By varying the criteria by which individuals from the unplaced pool are selected to join a camp, the simulation can approximate bilocal and unilocal residential systems. In the bilocal condition, both men and women from the pool of unplaced individuals can be selected join the camp if they have a genetic kinship tie to any man or woman in the existing camp. In the unilocal condition, only men from the pool of unplaced individuals who are genetically related to an existing male camp member can be chosen to join the camp. In both conditions, the degree of kinship required for an individual to be chosen to join a camp can be varied from only very close consanguineal kin (r = 0.5, equivalent to full siblings, parents, and children) to any consanguineal kin ($r > 0$).

The simulation described above was run 100 times for each kinship and dispersal condition (1000 simulations in total). As shown in Figure 3.2, bilocal

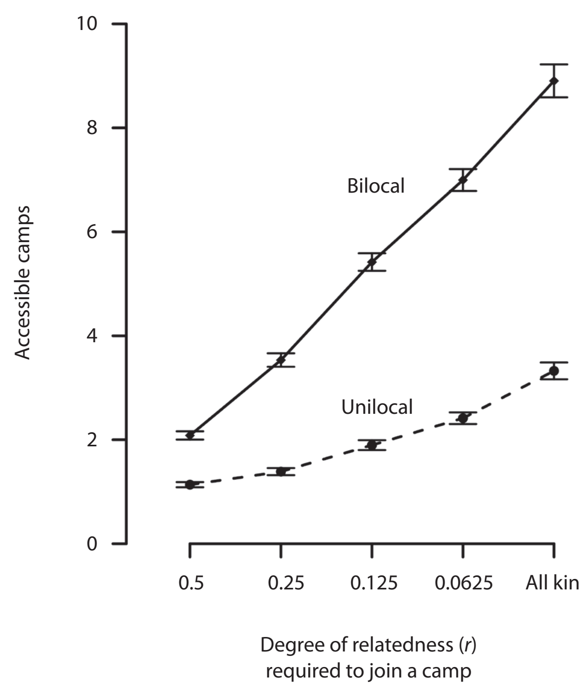

Figure 3.2. *Number of camps, out of a total possible of 15, in which the average household is permitted to live given various residential rules and the simulation procedure described in the text. Bars represent the standard deviation across 100 simulations. Solid line = bilocal residence; dotted line = unilocal residence.*

residence permits an average household to reside in two to three times more camps than does unilocality across the range of kinship restrictions. For example, with a kinship requirement of at least $r = 0.125$ (equivalent to the genetic relationship of full first cousins) and under bilocality, the average household had 5.42 camps (SD = 0.17) in which they could reside as compared with 1.90 camps (SD = 0.09) under unilocality. Such a difference is consistent across the range of rules governing the degree of kinship required to join a group. This result suggests that where either sex can influence where their household may reside, as in the kind of bilocal or multilocal residence systems typical of many hunter-gatherers, household members will have access to a substantially larger number of camps. At an individual level, this may be highly advantageous in facilitating access to a broader range of foraging locations, allowing individuals to take advantage of resources that are patchily distributed in space and to avoid local resource depletion or environmental failure.

Conclusion

As explored throughout this volume, inequality may be manifested in many domains of hunter-gatherer social, cultural and economic life. In this chapter I argue that equality in residential decision-making, and the highly flexible bilocal or multilocal residence systems it promotes, may have had many important consequences for human social evolution. Firstly, multilocal residence increases the frequency of interactions among unrelated and unfamiliar individuals, requiring cooperation to be negotiated through more cognitively demanding processes such as the monitoring of reputation and the development and maintenance of social norms. Secondly, these increased rates of interaction between bands may also serve to facilitate the levels of information exchange required for cumulative cultural evolution. Finally, bilocal or multilocal residence reduces relatedness within residential groups and, as shown here, can significantly increase the number of camps in which a household is permitted to reside, allowing individuals access to a broader range of foraging locations.

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Chapter 4

Surplus, storage and the emergence of wealth: pits and pitfalls

Christophe Darmangeat

The question surrounding the origins of economic inequality is probably as old as social science itself, and can be traced back at least to Rousseau (2004 [1751]). Among materialist scholars, the most common answer, which until today has remained a reference framework, may be called 'surplus theory'. Its most famous formulation, which was put forward in the first half of the twentieth century by Gordon Childe (1954 [1942]), can be summarized as follows: economic inequalities, which gave birth to the exploitation of work and the emergence of social classes, originated in the transition to agriculture and animal husbandry. This shift in the methods of production generated a food surplus which provided the base of the existence of all non-food producers: craftsmen, merchants, soldiers, priests and nobles. Childe's surplus theory was not, strictly speaking, radically new; it incorporated several elements already developed by previous thinkers (for instance Turgot 1766; Engels 1954 [1878], 1972 [1884]). But it was considered as a synthesis based on the archaeological record – especially, the Near East and European sequence – which, in return, provided the logic for understanding this record. Despite the numerous criticisms it has faced, the concept of surplus remains a key reference in archaeological studies dealing with economic inequalities in prehistory (Bogaart et al. 2009; Morehart & De Lucia 2015; Bogaard 2017; Hastorf & Fowhall 2017; Kohler et al. 2017).

Before addressing 'surplus theory', it is necessary to stress that the debate about the emergence and widening of inequalities is often conducted in general terms which encompass the political dimensions of societies. There are obvious reasons for this tendency: the global evolution of human societies was marked by the development of wealth inequalities and political hierarchies; in other words, it was a general move towards the formation of social classes and States. These two aspects were of course not independent, and it is tempting to treat them as a single phenomenon. This is particularly the case with the literature pertaining to chiefdoms, where the enforcement of political hierarchy is always strongly linked to economic differentiation, leading to the impression that one goes necessarily in hand with the other. Yet, it has long been noticed that the different dimensions of societies did not evolve everywhere in the same directions, nor at the same pace (Feinman & Netzel 1984). From a very global standpoint, if the economic and political inequalities appear as two aspects of the same general trend, as soon as one refines the picture, these two aspects are far from being synonymous. This is probably the most relevant objection raised by O'Shea & Barker (1996) or Testart (2005) against the neo-evolutionist classification. A telling example can be found in North America, with the comparison of the Iroquois confederation and the Northwest Coast societies. Although wealth was present in both sets, it was much more conspicuous and played a far greater role in the Northwest Coast. Yet, and despite their frequent qualification as 'chiefdoms', none of the societies of the Northwest Coast had elaborated a formal political structure. The power of their chiefs and aristocrats was based above all on their economic influence – even their famous 'titles' validated through the potlatches were not political functions or rights, but mere marks of honour and dignity (Drucker 1939). Conversely, the Iroquois, although much more egalitarian, are well known for their political constitution, with all of its formal elections, councils and procedures (Morgan 1922 [1851]). It is therefore necessary to stress that the origin of economic inequalities must be studied in itself, and should not be confused with the emergence – and even less with the further development – of political hierarchies.

We can now come back to surplus theory, noting that if its original formulation revolved around agriculture, it has subsequently become increasingly associated with another element, that is, storage. This is the reason why this paper aims to answer two essential questions: 1) should the surplus (or the ability to produce a surplus) be considered as a necessary or sufficient cause for the emergence of economic inequalities and exploitation of work? 2) Which empirical and theoretical links can be established between storage and wealth? In other words, if storage matters, then why?

Surplus, exploitation and labour productivity

Some decades ago, the question of surplus raised an intense debate (Pearson 1957; Harris 1959, 1961; Dalton 1960, 1963; Rotstein 1961; Orans 1966), which ended without reaching any agreement. Some later contributions (Testart 1979, 1982a, 1985) did not receive much attention. In a recent publication (Darmangeat 2018a), we tried to take the discussion one step further. The main starting points can be summarized as follows:

1. As several scholars noticed, in its crudest formulations, surplus theory is a mere tautology. If the surplus is the part of the social product that is appropriated by the non-producers, saying that exploitation is explained by the presence of a surplus is calling the same phenomena by two different names, without providing any causation.
2. The only way by which surplus theory provides a real explanation is by stating that exploitation comes from the possibility of extracting surplus which, in the classical Marxist formulation, is equated with a rise of the productivity of labour.
3. In this framework, however, a minimal level of the productivity of labour provides only the necessary condition for the emergence of surplus. It says nothing of the reasons why the possibility became a reality. Nevertheless, it is almost always treated as if the possibility was a determination, so that the necessary condition was *ipso facto* a sufficient one. Another way of stating this idea is to remark that an improvement in provisioning may well result in an improvement of well-being or in a demographic increase, rather than in the emergence of exploitation relationships. In this way, Childe noticed the lag of several millennia between the birth of agriculture and the rise of a ruling class without giving any clear explanation.
4. Linked to the previous point, surplus theory also remains silent on the social forms under which inequalities and exploitation are supposed to have developed. Saying that they could emerge, or even that they had to, is not explaining why they took some definite shape and not others.

Given points 3 and 4, one can argue that surplus theory is, at best, incomplete. This incompleteness is also visible in the fact that the theory uses the same cause – the 'overproduction' in the food sector – to explains two very different phenomena, that is exploitation of the productive workforce in general and mere division of productive labour. Significantly, in Childe's descriptions of the new social groups living on food surplus (1954 [1942]: 30–1), craftsmen are lumped with soldiers and priests.

In sum, the theory appears not only to be insufficient, but also to present some serious flaws.

Is egalitarianism a consequence of an insufficient labour productivity?

One of its main propositions is that the lack of economic inequalities and exploitation in hunter-gatherer societies is a consequence of the low level of their labour productivity. As Engels puts it, 'At this stage human labour-power still does not produce any considerable surplus over and above its maintenance costs' (1972 [1884]: 118).

It seems, however, that Marx and Engels had at least some hesitations on this matter. In chapter XVI of the first Book of *Capital*, Marx stresses that an adequate labour productivity is never a sufficient condition for the exploitation to take place; the producer has to be forced by some social mechanism to work beyond his own needs. He illustrates this idea with various examples, one of which is a primitive society of New Guinea where people satisfy their needs by 12 working hours a week, and where, if capitalism was introduced, workers might be compelled to work 6 days a week just to get the same product for themselves as before. The surprising (and seldom noticed) element in this passage is not the main idea, but the fact that the example chosen – a society where 'sago grows wild in the forest' (Marx 1909 [1867]: 585) – is clearly a hunter-gatherer one. Marx, then, did envisage in one of his major works published in his lifetime, that within such a society, an adult could possibly maintain himself and his family with a very limited amount of work, which would have left place for 'considerable surplus'. To some degree, Marx seems here to anticipate Sahlins' later developments on the 'original affluent society' (1972) and, for sure, contradicts Engels' statement.

More generally, in all hunter-gatherer societies, even those living in the harshest climates, productive adults provide food for various unproductive members of society, being they young, old or ill. This means that even if labour productivity was too low for people to feed an exploitative class in addition to perpetuating themselves as a collective, an individual adult (say, a prisoner of war) would nevertheless be able to produce significantly more than his own needs and thus, to be exploited.

The same conclusions arise from reasoning involving demography and the economic laws constraining these societies. Although the population dynamics of hunter-gatherers, and its possible specificities compared to agricultural people, gave rise to a considerable body of literature (Bentley et al. 1993; Pennington 2001; Bocquet-Appel 2011) there are few certainties. Several scholars, the most famous being Sahlins (1972), claimed that hunter-gatherers manage to maintain their population size below the optimum through cultural practices, thus ensuring that they can live relatively well without too much work. It seems, more probably, that hunter-gatherer populations tended to grow, albeit slowly, when resources became abundant and underwent Malthusian crises from time to time, which severely cut down their populations (Belovsky 1988; Winterhalder et al. 1988; Keeley 1988; Boone 2002). In either case, it can be argued that they could have sustained, to a certain extent, the maintenance of unproductive individuals. It is obvious in the first case. But, even in the second situation, the levy taken by some exploiters, instead of leading the whole society to disaster – the fate commonly predicted – might rather have resulted in a sustainable reduction of the number of their members. This counter-intuitive proposition is the consequence of the law of diminishing returns, which works in two opposing directions: if an increasing population, living in a given territory with given techniques, will face a fall of its labour productivity, conversely, a reduced population under the same conditions may well see its productivity rise. This gives way to an increased product, which may signify demographic growth… or the maintenance of some additional non-productive individuals. The mechanism exposed here is similar to the one described in an agricultural society, when taxes are imposed on the workforce and employed to pay the luxuries of the dominant class (Winterhalder et al. 2012).

Admittedly, it would be absurd to maintain that every society, whatever its environment and techniques, could bear the burden of an unspecified number of unproductive individuals. If, as we said previously, every worker, even in the poorest society, may normally produce a surplus over his own needs, it does not mean that this surplus is infinite. In a harsh environment, where a significant amount of work is necessary to get just enough food for the society to survive, this potential surplus margin remains narrow. Moreover, one should not oversimplify the way in which the 'law of diminishing returns' applies – and, conversely, the benefit in terms of labour productivity in the case of reduction in the population below its carrying capacity. This benefit depends on the circumstances and, below a certain density, may well be equal to zero, especially under hostile climates. But, once again, this should not conceal the fact that in every hunter-gatherer society, even the poorest – and much more so in the affluent ones, as Marx already observed – the presence, to a certain extent, of unproductive exploiters was economically viable. If there were none, even when a certain social relationship was obviously marked by domination (Darmangeat 2015a), it should be attributed to other (and social) reasons.

Agriculture and the rise of productivity

The third line of difficulties which surplus theory presents pertains to the idea that agriculture increased labour productivity, thus allowing the surplus to come into being. An increased labour productivity may lead to three possible effects:

1. the increase of leisure time, as in the famous example of the Australian Yir-Yoront who invested the benefits of the steel axe 'in sleep – an art they had mastered thoroughly' (Sharp 1952: 20).
2. the increase of the product, whether this increase returns to the producers…
3. or is appropriated by a dominant class.

In theory, these effects should be identifiable, in particular the first one. In Marx's thought-experiment with wild sago gatherers, the surplus would simply result from an external constraint, and in no way from an increase of labour productivity. With the exception of modern societies, addressing this question is extremely problematic as work duration can only be estimated with great uncertainties. However, in the last decades archaeology has collected various evidence on the advent of agriculture which all point in the same direction: that cultivation did not lessen the work effort. A comparison of the various figures taken from ethnological studies do not show that workload is smaller in cultivation societies compared to foragers – actually, the opposite is the case (Darmangeat 2015b).

Concerning the second possibility, the global well-being of populations does not seem to have improved with agriculture, at least in terms of health. If data concerning mobile hunter-gatherers are too scarce to compare their life expectancy with that of cultivators, the global health conditions seem to have worsened with agriculture (Steckel et al. 2002; Larsen 2003).

The only tangible result of the increase of labour productivity which is supposed to have followed the Neolithic revolution would thus have been the formation of a dominant class living at the expense of the workforce. Although this formation stands beyond any doubt, an essential point is that it may have resulted from many causes besides an increase in the productivity of labour. Compared to the modest material culture of nomadic hunter-gatherers, the monumental achievements of the early States are impressive. But one should keep in mind that they were enabled, above all, by a huge expansion of the population – the tremendous gap between the population densities among nomadic hunter-gatherers and cultivators is a well-known fact. Several scholars have already noted that even in the early States, technical tooling in agriculture remained often very primitive and the amount of surplus-product which could be extorted from each individual worker very constrained (Mazoyer & Roudart 2006 [1997]; Trigger 2003: 313).

Of course, it is not argued that the technical progress from the Upper Palaeolithic to Antiquity was negligible. However, this technical progress mostly did not result in an increase of productivity of labour but rather of land, a phenomenon known as the 'Malthusian trap'. Under this model, the improvement in the techniques of subsistence tends to bring about population growth; this, on the basis of a given technique, faces the law of diminishing returns, and while productivity of work initially rises through technical progress, it eventually falls back to its starting point. In a somewhat provocative formulation, it is sometimes said that during earlier millennia, technical progress did not serve to feed the poor better, but only to feed more poor per square kilometre. This process is at the core of what archaeology often calls 'intensification', although the precise meaning of this word has been subject to much debate (Boserup 1965; Kayser & Voytek 1983; Bender 1978, 1981; Kirch 1994; Morgan 2014; Morrison 2014). This also explains why a careful ethnologically based comparison between foragers and cultivators leads to the conclusion that Neolithic-like agriculture shows no better performance in terms of labour productivity (Bowles 2011).

In actual fact, and contrary to an opinion sometimes supported elsewhere (Wood 1998; Galor & Weil 2000; Clark 2007; Ashraf & Galor 2011), this conversion of productivity of labour into productivity of land was not complete. Part of technical progress was devoted to production that had no impact on the number of producers, starting with the luxuries of the developing dominant class (Wu 2015; Svizzero & Tisdell 2015). These productions represent a partial escape from the Malthusian trap, and in this respect, it is possible to say that surplus was much more a consequence than a cause of the emergence of wealth, economic inequalities and exploitation of labour.

If productivity of labour had a much lesser effect on the profitability of labour exploitation than commonly thought, it should be noted that the productivity of land, for its part, had a positive impact that has often been overlooked. Productivity of land affects the density of a population and therefore, the cost of oversight and control of labour power. We said previously that economic exploitation was formally possible among hunter-gatherers, but there is no doubt that extracting a surplus-product from a nomadic hunter would have represented a considerable cost compared to the yield. Conversely, sedentism and the much higher population densities it allows made political and economic control – without which exploitation is impossible – much easier. In economic terms, it is probable that the gross profitability of exploitation benefited less from the rise of productivity of labour than the net profitability benefited from the rise of productivity of land.

Why storage matters?

Another debate developed some decades ago, when some scholars advocated taking into account the ethnographic – and, most probably, archaeological – cases of so-called 'complex' hunter-gatherers who had developed high levels of economic differentiation. These hunter-gatherers, firstly those of the Northwest Coast, showed that the demarcation between economically egalitarian and non-egalitarian societies was not exclusively linked to agriculture, as it was commonly said, but rather to storage (Testart 1982b; Ingold, 1983).

This shift in perspective was of considerable importance, and raised two sets of questions. First, on the empirical level, to what extent was there a relationship between the practice of storage and the presence of economic inequalities? Were both phenomena strictly correlated or were there exceptions? Second, if storage is indeed related to wealth inequalities, what are the causes involved? We will begin by addressing the second question, assuming that if there are a few certain or possible exceptions to the empirical adequacy between storage and inequalities, this adequacy is widely ascertained and provides a solid starting point.

What kind of 'surplus' is storage?

First of all, two points about the relationship between storage and surplus theory have to be clarified.

It could be argued that storage only modifies this theory on a secondary point, by simply changing the factor which increased the productivity of work (storage instead of agriculture). In itself, such an adjustment would raise no particular problem. However, for obvious reasons, such an opinion was seldom argued; instead, one more often reads that storage is, by nature or to a certain extent, a surplus (for instance, Bogaard 2017).

This point illustrates a recurring ambiguity. A 'surplus' is an excess of one quantity over another, but one should never use the word without specifying which quantities are involved – a problem which has always greatly contributed to obscuring the debates on this topic. According to Marx or Childe, the surplus is the excess of production over what the producers receive – that is the reason why it can be called 'social'. This is significantly different from the physiological surplus which was referred to by cultural ecology, and which names the excess of production of a given society over the biological needs of its members. Stocks, in a sense, are also a 'surplus': the excess, at a given time, of past production over consumption. But it is easy to see that they are, by nature, neither physiological nor social surplus. Speaking of storage as 'surplus' is therefore not illegitimate, but it introduces confusion. At worst, by lumping together storage and exploitation of labour under the same designation, it hides the fact that both phenomena are analytically different, and that the empirical link between them has to be explained.

Several scholars have noticed the problem; Arnold, for instance, rightly stressed that the question is not storage in itself, but the control of others' work (1993: 93). Yet, the question remains why both phenomena are so often, if not always, linked in the empirical record. The same preoccupation led others to propose a differentiation between 'normal surplus', corresponding to the needs of the immediate producers in order to face the resource cycle, and the surplus strictly speaking, which can be appropriated by a ruling elite or, at least, take the form of wealth (Halstead 1989; see also Kirch 1984; Bogaard et al. 2009; Kuyt 2015; Winterhadler et al. 2015). This discrimination is based on the idea that social surplus comes necessarily in addition to the product managed by the households. It may be useful, in particular, to identify social processes often related to chiefdoms in the archaeological record (Wesson 1999); yet, it does not provide any real clues of the reasons why the 'normal surplus' might or should give birth to a social one – in other words, how and why storage led to economic inequalities and exploitation of labour.

From storage to wealth: three hypothesis

To this riddle, three main answers have been given.

The first one, probably the first that comes to mind, is based on the physical properties of stocks as durable and movable. They may thus be appropriated and centralized by some hierarchy – one possibility is the case of collective supplies being at first administrated by leaders for the common sake, and then used for the selfish interest of their managers. This idea seems to be as old as the discovery of the importance of storage for economic inequalities itself (Testart 1982a), and was recently put forward to explain why economic inequalities arose when the crops were grains, and not tubers (Mayshar et al. 2015). While it may contain some truth, this reasoning states, at best, a necessary condition: it does not explain why the households agreed to be deprived of part of their production, or how they were compelled to produce it in addition of their needs, a question rightly raised, for instance, by Arnold (1993). Neither does it explain why, even in the absence of a political hierarchy, numerous societies display important inequalities of wealth between households.

Another hypothesis was advocated by O'Shea (1981), under the name of 'social storage'[1] (see also Rowley-Conwy & Zvelebil 1989; Halstead 1989) and deserves a careful examination. O'Shea suggested distinguishing between 'direct' and 'indirect' storage, the latter encompassing 'all those processes which transform foodstuffs into a more stable, alternative form, from which food value may later be recovered.' (1981: 169). Indirect storage, in turn, took two very different forms. The first one is exemplified by animal husbandry. If we put this aside, 'the transformations which are characteristic of indirect storage are *cultural*, and involve the equivalencing of foodstuffs and non-food items through exchange. (…) when such exchange is extended between corporate groups or villages, some manner of physical token usually enters the transaction. In such a transaction, food is exchanged for some non-food token with at least the implicit understanding that such tokens can later be re-exchanged for food. This type of exchange transaction is here referred to as *social storage*' (ibid.).

It is easy to understand why the emergence of social storage was a major turning point in social evolution: 'The use of tokens as a means of storing food value introduces a new dimension into primitive economic systems, the ability to accumulate wealth.' (1981: 177) – therefore, O'Shea added, to accumulate it in an unequal way. Among many others, Halstead (1989) in particular stressed the consequences of the hazards faced by households that created growing inequalities, opening opportunities for some successful ones to reduce impoverished ones through dependency.

This hypothesis has several indisputable merits, the main one being an attempt to account for the origins of wealth. Wealth, in its strict sense, does not exist in every society, and its birth is here correctly identified as a social process. Yet we think it contains several major defects.

First, the demarcation between 'direct' and 'indirect' food storage seems questionable. Concerning food storage strictly speaking, the only example of indirect storage which is given is animal husbandry, and one does not see why it should be distinguished from the smoking of fish, for instance. Almost no food can be stored without being 'processed in a more stable form' – which would mean that food storage is always 'indirect'. But the critical point is that 'social storage' is actually not storage at all, unless this word is used in a very vague (and deceiving) sense. This so-called 'storage' only 'stores' the possibility of others acquiring the stored food: it is nothing other than a monetary saving. It is indeed striking that O'Shea, whose theory deals with the emergence of money, describing two of its well-known functions (as a medium of exchange and store of value) and exposing the inflationist risk, never explicitly describes it as 'money', preferring for unknown reasons to speak of 'tokens'. However, primitive money which always takes the form of precious goods, is far less a 'token' than our own bank notes or electronic payments.

The essential point is that this theory revolves around the question of exchange: in order to obtain food from other communities in times of need, societies would have established the equivalence between non-food and food goods. This reasoning differs from the classical narrative which dates back at least to Adam Smith, whereby money was designed as a mean of facilitating a pre-existing barter. Money as a means of exchange is nevertheless at the core of both theories, an idea which should be challenged for several reasons.

To begin with, it is a well-known fact that in all of the ethnographic cases where wealth is present, although it may be used to acquire foodstuffs, there is a general reluctance of proceeding with such exchanges. Trading precious items against food is widely considered as abnormal, to the extent that various anthropologists have claimed that 'prestige' items form a separate category with no interference with basic necessities. For instance, Gould (1966) showed this statement to be clearly excessive for the Tolowa Indians of California, but he also stressed how much it was unusual, and somewhat inglorious, to trade precious goods against food. On this matter, the Tolowa must be regarded as quite representative. Thus, it seems somewhat contradictory to acknowledge this, as Halstead (1989) willingly does, while maintaining that wealth was initiated in order to facilitate such exchanges.

The solution of this paradox is provided by a third line of explanation, following on from Testart (2001, 2005), who stressed the particular role of wealth in primitive societies:

> What is the point of wealth in primitive societies? (…) The absence of any division of labour or, at least, its weak development, which allows everyone to produce his subsistence, induces that one does not need wealth for living. Because of the absence of fundiary[2] land ownership, wealth cannot be invested in productive goods and does not, by itself, generate profit. (…) Such an unnecessary and undesirable wealth (…) has none of the functions it achieves in our societies. In view of this fact (…) there are only two possible answers. The first is to say that wealth is useless. (…) It think that [this] is the typical answer of classical anthropology. (…) [which] pretends that it is purely conspicuous and does not serve any material purpose (…) The second answer, which is ours, is to say that this primitive wealth (…) is not a pure prestige concern because (…) it serves to payments of social obligations, imposed by law or custom, and quite mandatory and compelling. (Testart, 2005: 29–30)

The statement that 'one does not need wealth for living' should certainly be qualified, and we can grant that wealth was sometimes used for this purpose. But the fundamental proposition holds true: the main function of primitive money, and the most probable reason for its emergence, was not as a means of exchange, but rather of payment. Wealth, in those societies (as the Tolowa case, among hundreds of others, confirms beyond any doubt) is first and foremost the way of managing bride price, blood money, and possibly the various fines or fees required to join some secret society. Testart also noticed that in societies where those payments had been established, the public display of wealth was a common feature, be it through feasts, competitive exchanges, 'grade passages', etc. In a whole category of societies that he called 'conspicuous plutocraties', which included for instance the Northwest Coast so-called 'chiefdoms', formal political structures were actually lacking and wealth was the organizing principle of social dominance.

The relevant question, then, is not knowing how storage gave birth to wealth as a means of exchange, but how it led to the emergence of payments. That is, to understand the possible links between storage and bride price, blood money, etc. In another words, we must examine the relationship between the practice of storage and the introduction of material goods in compensations where, up to now, only human work, blood, or kinship ties were involved.

Towards a new solution

Testart confessed to be at loss with this problem (2005: 37–8). The only attempt he made was posthumous and unfinished (2014). Moreover, the question he tried to address was actually different: he was convinced that, at least for marriage, life-time obligations were characteristic of Australia. Everywhere else in the world, life-time obligations had preceded all the other forms, including the bride service – the well-known 'sister exchange' was curiously absent from his reasoning. To his eyes, these configurations of matrimonial compensation had a key impact on the technical progress, and the 'backwardness' of Australia, as well as the long-supposed stagnation of the European Upper Palaeolithic. It is not possible here to enter into details, but this reasoning turns out to be, at best, very questionable (Darmangeat & Pétillon 2015; Valentin & Pétillon 2018). The main point relevant to the present discussion is that the riddle of the extension of material goods (and, thus, wealth) into marriage and damage compensation, and its possible link to storage, remained unsolved.

Another common answer is offered by Hayden, who states that this evolution was manipulated, if not orchestrated, by a certain category of individuals he calls 'aggrandizers'. These individuals exist (biologically) in every society, but it is only with the conditions of what he calls the 'transegalitarian' societies that they found themselves in a position to apply their talents to material production. This was executed through a number of 'strategies' (the term appears regularly in Hayden's writings) among which we find the institution of bride price (2014: 165–6). However, it seems problematic to explain a social phenomenon, specifically the emergence of new social structures, through the strategies of a social group. This methodological individualism can hardly be something more than a dead end. No one could deny that in every society there are people with certain inclinations or talents to boast who acquire power and take the lead, eventually at the expense of others. But the reason why capitalism superseded feudalism is not because some individuals would have preferred to get rich through industry, trade or banking instead of mere military power. Generally speaking, individual strategies are explained by social structures, and not the opposite. Thus, seeing bride price as a result of a strategy pursued by aggrandizers, as a conscious will of part of the society, is at best partial, and at worst misleading. Long ago Engels pointed out that societies consist of intersecting contradictory wills and actions, and that the resulting situation is often something nobody had foreseen nor wanted. Furthermore Lemonnier, in a short but enlightening article (2008), highlighted how bride price among people of New Guinea, probably – and ironically – resulted not from the desire to widen inequalities but rather, the desire to reduce them. Thus, a scientific and therefore materialistic social explanation cannot consider the will of social actors as ultimate causes; conversely, it has to explain these wills through social structures and their evolution.

In the quest for understanding the relationship between storage and the emergence of wealth, the empirical record provides some essential clues. We refer here to a database dealing with payments and slavery that we built by combining two existing datasets, to which we have added our own information concerning storage (Darmangeat 2018b). Despite the numerous difficulties and inevitable disputable choices,[3] we think that some useful insights can be deduced from this material which includes 237 cases.

The first observation is that in the vast majority of societies storage and payments are altogether either absent or present. This supports the close link mentioned previously between both features, which may of course be read as an evolutionary proposition: the dichotomy roughly overlays the opposition between mobile hunter-gatherers on the one hand, and sedentary hunter-gatherers and cultivators on the other. Incidentally, our data also show that the slavery group, with very few marginal exceptions, is a subset of payment societies. This strongly supports the opinion that slavery is a by-product, and not a cause in itself, of wealth.

To return to our central question, it is also worth considering the few cases which seem to invalidate the correlation between storage and payments. These exceptions belong to two categories. The first one includes societies where storage is practiced but which, possibly or clearly, lack payments. Our sample includes six of such societies. Without going too far into detail, all of them are marked by wealth inequalities, although these are far more salient in certain cases (Conibo of Amazonia, Bemba of Africa, Tareumiut of Alaska) than in others (Toda of Gran Chaco, Zuni and Hopi pueblo Indians). The deficiencies of our information on several of these tribes makes it difficult to draw reliable conclusions. Nevertheless, it seems that with respect to payments, the Tareumiut case reveals an alternative, although obviously infrequent, path towards the emergence of wealth. Among these Inuit, rich people (called *umealit*) are the owners of the boats used to hunt big sea mammals, especially whales, or alternatively, individuals who control a trade route (Spencer 1959; Johnson & Earle 2000: 177). The reasons which could explain the near absence of payments among the Tareumiut are difficult to identify – more generally, the resistance to the development of payments seems to be a feature of the whole Inuit cultural area. Conversely, one may put forward the hypothesis that in the specific conditions of coastal Alaska, the development of wealth inequalities may have involved specific mechanisms which, in a slightly anachronistic way, can be called 'capitalistic'. More probably, these tendencies were present elsewhere, but their importance remained secondary. The main means of production were the whale boats, produced at an expensive cost, which were individually financed but collectively used. This contrasts strongly with the general situation where the main means of production is land, available for anyone willing to clear it. The few individuals who possessed these boats held at least an economic power which was manifested in the right to levy part of the catches.

Correspondingly, our sample shows four (possibly five) societies in which payments were present but whose economies did not rely on any form of food storage. These societies challenge the role of storage in the same way that sedentary hunter-gatherers challenged the role traditionally assigned to agricultural societies. Incidentally, it is puzzling that Testart, who had identified these cases quite clearly, did not try to address the problem they posed to his theory. Some of them were hunter-gatherers living in environments rich enough to allow them to be sedentary without practicing any form of storage. One example is the Calusa, a Florida tribe known only by early Spaniard witnesses (Fontaneda 1944 [1575]) and archaeology (Gogin & Sturtevant 1964; Hutchinson et al. 2016; Thompson et al. 2018); another is the Asmat, a tribe living on the south coast of New Guinea, whose main resources were wild sago starch and fishing (Sowada 1961; Eyde 1967; Trenkenshuh 1970; Van Arsdale 1975). Another category is what Testart called 'mounted hunter-gatherers', that is, hunter-gatherers who used domesticated horses for hunting. Strictly speaking, this excludes the plains Indians, who were to a certain extent cultivators, even when they relied heavily on hunting on horseback (Zedeno et al. 2014). In the Gran Chaco, the Abipon tribe falls obviously into this category (Dobrizhoffer 1822 [1754]). All of these groups experience wealth inequalities although to varying degrees, ranging from only just discernible among the Asmat, to the high level among the Calusa whose society, with its slaves and its supreme leader, has often been qualified as a chiefdom. It is also worth mentioning some intermediate situations like the Jivaro of Amazonia. Traditionally, these and many other people in this area were manioc cultivators who ignored both storage and payments. Marriage in particular involved a bride service from the future husband, without any significant transfer of material goods. However, the situation changed with the arrival of western rifles, which could be given instead of the traditional service, or to compensate a murder and put an end to a feud (Harner 1972).

The ethnographic information concerning the Calusa and the Abipon remains sparse, but what we know about the Asmat and the Jivaro enables us to suggest an answer to the question of why, in the absence of any food storage, a society may – or had to – engage in the transition to payments in particular, and to wealth in general. Our hypothesis is that the trigger is *the existence, on a sufficiently large scale, of moveable, durable goods requiring an important amount of (individual) work for their making* (Darmangeat 2017). These goods, once they exist on a sufficient scale, can be held for the equivalent of the prolonged time of service that is the most common form of matrimonial compensation among societies ignoring wealth, and thus it begins to replace it. Then, by a well-established equivalence, they also replace the human blood (or spouse) in murder compensations. We propose calling this category of goods 'W goods', W being the initial uniting work and wealth.

It has often been noticed that in lowland Amazonia, societies were 'primarily oriented toward the production of persons, not material goods' and that they were marked by 'the limited involvement of wealth and prestige goods in producing social relationships' (Fausto 1999: 934). Among the Jivaro, the rifle was then an imported exception. If we turn to the Asmat, there are several possible W goods, but the most evident one is the canoe. We do not know the exact amount of work needed to manufacture them, but a witness wrote that a large canoe represented about two months of individual effort (Eyde 1967: 45), in a time where metal axes had already replaced traditional stone ones. It is very probable that this figure should be greatly revised upwards when talking about pre-contact times. In any case, the making of a canoe, which constituted the most important manufactured property of the Asmat (Van Arsdale 1975: 36), was 'one of the principal duties a man has to his wife's brothers or father, and a man should give a canoe to his fiancé's brothers or father before marriage' (Eyde 1967: 43). This obligation seems to have existed even in the specific situations of marriage that did not imply the payment of a formal (and additional) bride price.

The 'W goods' hypothesis not only explains why some societies lacking food storage achieved the transition to payments and wealth, but it also gives a decisive clue to the reasons for which it was the general case in societies whose economies relied on food storage. As a matter of fact, food stores are by definition W goods; thus we can assess that where there is food storage, there have to be payments – with the few possible or clear exceptions already mentioned. Admittedly, food articles seldom constitute a noticeable part of the bride price or of blood money, and this could be held as an objection against the W goods hypothesis. Yet, the paradox is only apparent. Preserved food is always a relatively low-value item, compared to rare shells, manufactured skins, canoes, etc. The only form under which food embodies a high value is that of a living domestic animal, typically the pig in New Guinea (Lemonnier 1993). In other words, if the goods used for payments are regarded as primitive money – and they should be – preserved food is usually only small change. Societies engaged in food storage tend to be sedentary and to produce also significant volumes of other goods embodying a higher amount of work which are thus much more convenient to be used as money. Therefore it is not surprising that in such economies, food stocks are almost never money goods, even though they are W goods. This is another way of saying that the 'prestige goods' often referred to in the ethnographic literature are a subset of W goods – those that were selected to be used in payment transactions.

Conclusion

In light of the discussion above, two main conclusions can be drawn. The first pertains to the archaeological interpretation of storage. If the presence of large and possibly public storage devices may indicate the existence of some kind of 'chiefdom-like' political structures, it follows that the observation of small-scale societies shows that any significant storage is a fairly good proxy of the presence of wealth, and thus of wealth inequalities. The correlation, as we saw, is not perfect. In fact, wealth may exist without any storage. Conversely, the possibility of storage without payments and, even less likely, without any kind of wealth should not be totally ruled out. However, this last configuration seems to be a very rare occurrence. Therefore, when the archaeological record seems to indicate such a case (Prentiss et al. 2014), the first hypothesis that should be considered is the archaeological visibility of wealth. In its early stages, wealth often does not appear in ostentatious forms (for instance, bigger houses), and sometimes not even as shells, beads or precious blades. Rather, the 'prestige goods' may be mainly represented by domestic animals given in payments and killed on some special occasions. If these occasions are memorialized through the preservation and display of animal parts, as it is likely the case in Çatal Höyük (see Testart 2006 for an ethnographically informed interpretation of the bovid crania which contradicts the egalitarian reading of Bogaard et al. 2009), the archaeologist is given reasonable evidence of wealth. If not, he might wrongly reach the conclusion of complete economic equality.

At another level, the W goods hypothesis provides a materialistic explanation of the transition to payments, and therefore in the vast majority of cases, to wealth differentiation. It is because societies began to invest higher quantities of work in durable goods that they began to regard these goods as equivalent to the work they embodied – as Gilman already observed, 'Wealth, after all, is a concentration of human labour into durable asset' (1990: 349). In a Marxist vocabulary, it may be said that the transition to payments, with the replacement of the bride service (or any custom related to it) by the bride price, represents the first victory of dead labour over living labour in the history of social relations. To conclude this point, we do not underestimate the difficulties that arise out of this general social law. Not only do few societies seem to have taken an alternative path to wealth than payments, but also it is possible that the same approximate level of W goods did not always lead to the same developments. As noted above, in the Inuit world where W goods are undeniably present (in the form of dogs, sledges or clothing), payments seem to have remained, at best, limited. The reasons that may explain this relative resistance, here and possibly in other cultural areas, require further research.

Notes

1. Not to be confused with what we called 'social surplus'.
2. Testart calls 'fundiary' a land ownership that is not founded on work. Land rent is associated with this form of ownership which, according to him, constitutes a criterion of a class-based society.
3. For a general presentation of our method and a case-by-case short discussion of our definitions, see http://cdarmangeat.free.fr/tryptique/donnees.html (in French).

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Chapter 5

Leadership and inequality among the Iñupiat: a case of transegalitarian hunter-gatherers

Alberto Buela

Understanding the bases and dynamics of leadership in egalitarian and transegalitarian societies constitutes a central aspect in the study of social inequality. Studies of inequality among transegalitarian groups have typically focused on the Pacific Northwest Coast foragers or Melanesian horticulturalists. However, little attention has been given to the Iñupiat[1] of Northwest Alaska. One exception is Sheehan's (1985, 1995) model of the evolution of social complexity and inequality with the development of prehistoric whaling in Northwest Alaska. This paper examines the bases, forms and dynamics of leadership and social inequality among the historic and contemporary Iñupiat.

The first section introduces the Inupiat and their traditional economic and social organization. The second section describes the traditional forms of leadership and inequality based on age, skill, knowledge, wealth, and gender. This section builds on the ethnohistoric and ethnographic literature on the Iñupiat and discusses it in relation to other egalitarian and transegalitarian societies, addressing some theoretical issues, such as big-man (and related) models of leadership (Hayden 1995; Sahlins 1963), the role of material wealth (Borgerhoff Mulder et al. 2009), storage (Testart 1982) and ritual knowledge (Roscoe 2000) in creating inequalities, as well as to the strategies employed by leaders to gain power and influence (Feinman 1995), and the forms of group affiliation and recruitment. It also responds to the need to pay more attention to gender and the role of women in anthropological and archaeological studies of leadership (Nelson 1997; Roscoe 2000). The third section analyses the changes in Inupiaq leadership and patterns of inequality brought about by contact with Euro-Americans and through the gradual integration of the Iñupiat into the state and a capitalist economy. This section is based both on existing studies and on a short, exploratory and qualitative fieldwork carried out by the author in 2015 and 2016 in the Iñupiaq community of Wales or *Kingigin*. The case study illustrates how different factors such as changes in subsistence, technology, population, economy, social organization and political institutions affect the bases and patterns of leadership and inequality, pointing to the need for integrating systemic with actor-centred approaches.

The Iñupiat

The Iñupiat inhabit the arctic tundra of Northwest Alaska, and their territory spans from the Norton Sound on the Bering Sea in the southwest to the border between United States and Canada on the northeast, covering the entire Seward Peninsula and the North Slope. The Iñupiat can be divided between inland groups, which mainly subsist on caribou; coastal and riverine groups that combine fishing with hunting of land animals and small sea mammals; and whaling communities. Whaling communities, which constitute the focus of this paper, subsisted primarily on large sea mammals (whales, walrus, seals), supplemented by terrestrial animals, birds, fish, as well as gathered eggs and plant foods. Whaling communities exhibited high population densities and high levels of sedentism, lived in large permanent settlements and summer campsites, had a strong reliance on storage, were territorially bounded, and were engaged in trade and warfare (Sheehan 1985).

The community of Wales (*Kingigin*) is located at the western tip of the Seward Peninsula facing the Bering Strait, slightly below the Arctic Circle and within the July 10°C mean isotherm, with an environment characterized by polar climate, arctic tundra, and sea ice covering during winter. Strategically located to intercept migratory sea mammals, Wales was one of the largest whaling communities of Northwest Alaska, with an estimated population ranging between 500 and 750 inhabitants during the nineteenth century (Burch 1975: 12; Ray 1992: 110), which was dramatically reduced after the influenza epidemic of 1918–19. Its current population is about 178 (Alaska Department of Commerce 2018)

Traditional Iñupiaq society (i.e. at the time of early contact), as described by Burch (1975, 2006), was organized in extended family groups composed of several households, each household comprising two or more conjugal families living in one semi-subterranean pit house with storage facilities. Kinship was reckoned bilaterally, but there was an emphasis on the male line as patrilineal links constituted the core of the main groupings. The extended family was the main economic unit and virtually self-sufficient, organizing most of production, distribution and consumption. Two or more extended family groups lived together in one settlement, but there was no village-wide political structure or authority above the extended family. The only supra-household institution was the *qargi*, a ceremonial and assembly house (sometimes referred to as the men's house), which served several social, political and ritual functions. In the *qargi* whaling crews prepared for the hunt, men worked on tools and equipment, young males were socialized, rituals and feasts took place and families exchanged food and goods. There were several assembly houses in the winter settlement and each of them belonged to one extended family and was led by a leader called *umialik*.

A central feature of traditional Iñupiaq society was a sexual division of labour, in which men hunted and made tools whereas women were in charge of processing and storing food and raw materials as well as gathering, and both men and women participated in fishing. While small seals could be hunted by individuals on foot or by kayak, large game – bearded seal, walrus and whales – were hunted by specialized task groups called hunting crews (also boat crews or whaling crews). Though their composition was fluid, hunting crews were relatively stable units that endured over time and played an important role in Iñupiaq socio-political organization. They were composed of male hunters and were organized hierarchically, with the *umialik* (captain and boat owner) at the top and the rest ranked according to skill and age. Hunting crew membership usually corresponded with *qargi* affiliation, and the groups formed thereby constituted the political factions of the village. Furthermore, crew members were generally recruited from different households within a single family group, thus contributing to the integration of the latter by establishing ties of cooperation and reciprocity. Each hunting crew used an *umiak*, a relatively large, open skin boat made of a wooden frame covered with split walrus hides, which was also used for moving whole families to summer campsites and for long-distance trade. The construction and maintenance of skin boats required intensive labour. While constructing the wooden frame was the task of men, women were in charge of splitting the hides and sewing them together.

Traditional forms of leadership and inequality

Leadership patterns were shaped to a large extent by an informal age hierarchy. The principle of seniority appears to have been ubiquitous in that older family members had at least some authority over their younger relatives, and head of households were generally senior males who had more authority than anyone else (Burch 2006). The unequal allocation of power according to age found among the Iñupiat differs from seniority as a factor for leadership among egalitarian hunter–gatherers (e.g. Endicott & Endicott 2012; Lee 1982; Woodburn 1982), in that in the former seniors have actual authority over juniors, by demanding obedience and applying sanctions, whereas in the latter they usually do not. There are also references in the ethnohistoric literature to the prominent political role of elders in the community at large. Ray (1992: 107) writes that: 'Every men's house [i.e. *qargi*] had one or more leaders, or chiefs [i.e. *umialik*], who worked in conjunction with an informal council of elders in matters of tribal affairs.' According to Burch (2006, 308), elders exerted their authority in the assembly house on matters of social control and regulation, and '[a]n *umialik* had to be extremely brazen to go directly against the collective wishes of the elders, and suffered an enormous loss of esteem and support if he did so'. He thus argues that 'the locus of the greatest institutionalized power in an Iñupiaq society resided in the elders, particularly male elders', and corresponded 'more to elders as a group than to specific individuals' (Burch 2006: 308). Nevertheless, it may be questionable to assert the existence of a gerontocracy or any formal age hierarchy, for elders did not constitute a ruling class nor did they monopolize resources or women, and there were no initiation cults.

Skill and knowledge were further factors for leadership. This applied especially to the role of the *ataniq*, a task-group leader for certain collective activities such as communal maritime and terrestrial hunting as well as warfare (Burch 2006: 68). Such activities required specific organizational skills and certain individuals were particularly apt and experienced. The *ataniq* was not a leader in general in the community, but rather limited to a certain activity: 'Context was crucial here' and thus the leader's 'sphere of influence fluctuated accordingly' (2005: 88–9). This is the kind of situational, task-oriented, and transient kind of leadership that exists among egalitarian hunter–gatherers (Barnard 2002: 9–10). Ritual knowledge was important in the role of shamans, but also in the role of the *umialik*, a leader and whaling captain. The *umialik* was in charge of organizing and directing the whaling cult and ceremonies that took place in the *qargi* before and during the whaling season (Spencer 1959). Ritual knowledge certainly had a function of legitimizing the role of the *umialik*, but it was probably not an important resource for getting to power, since his ceremonial and ritual duties were acquired or lost depending on his ability to accumulate certain wealth in order to enlist a crew.

In effect, material wealth was the defining feature of the *umialik* – the most prominent Iñupiaq leader – and constituted the main difference between Iñupiaq leadership and that of egalitarian hunter–gatherers. The Iñupiaq term *umialik* has several meanings, including 'boat owner, leader, boss, and rich man' (Burch 2006: 66). This achieved position, though it could eventually be lost, was not restricted to specific tasks: 'The umialik role, unlike the ataniq role, was not context sensitive: a rich man was wealthy whether or not he actually directed a particular activity or crew' (Burch 2005: 153). The *umialik* was a successful head of family, a boat owner and crew captain, and a good trader. His wealth consisted in stored food surpluses (mostly sea mammal products), hunting and transportation equipment, and trade goods (primarily furs) (Burch 2006: 67).

Ownership of boats was a fundamental factor in the role of the *umialik*, as the skin boat 'was regarded as the most valuable single piece of property' (Spencer 1959: 156). After all, it was the technological means with which the community obtained the bulk of their subsistence, including food and raw materials. As a boat owner and crew captain the *umialik* had certain duties and privileges: he not only directed the division and distribution of large game (walrus and especially whales) but also kept the largest and best parts (Burch 2006: 160–9; Thornton 1931: 170; Worl 1980). According to some observers, crew captains also restricted the access to walrus hides needed for boat covering and only obtained by boat crews, thereby preventing other (younger) men from creating their own crews (Bogojavlensky 1969: 70; Ellanna 1988: 112–13). By owning boats and limiting access to its raw materials, crew captains controlled this central means for production, making other people dependent on them for subsistence. This is one of the main features that distinguishes non-egalitarian, delayed-return systems from egalitarian, immediate-return systems, where there is no dependency on specific others (Woodburn 1982). This dependence allowed the *umialik* to have some control over labour and surpluses produced by others. Even though there were no formal rules of inheritance nor any inherited ascribed status, skin boats as well as other material wealth were likely to be inherited, usually by the oldest son of a crew captain, and with it also the *umialik*'s role and status (Burch 2006: 314; Ray 1992: 107). This is a significant aspect, since the relative importance of material wealth (in relation to embodied and relational wealth) in a society and the extent to which it can be transmitted over generations account for higher economic inequalities (Borgerhoff Mulder et al. 2009), which constitute the basis for stronger leadership.

Ownership of boats was a necessary but not sufficient condition for becoming an *umialik*. A crew captain also needed to be able to create and maintain a network of supporters, and for this purpose he needed to accumulate and manage food surpluses. Given the high seasonality of their environment, the Iñupiat relied heavily on storage, especially during the winter. Food was stored in cellars or storing facilities inside the houses, which belonged to the extended family and its component households. Storage has been identified as a factor, or at least a precondition, for social inequality (Testart 1982). In the Iñupiaq case, the large food surpluses that became available with the development of effective whaling technology and the possibility to store them, enabled the *umialik* to become a redistributor in addition to a hunt leader (Sheehan 1985). The *umialik* provided his crew and family members with gifts and material support, not only during the hunting season but also during the winter (Bogojavlensky 1969; Burch 2005, 2006; Spencer 1959). In this way, he created a followership whose loyalty extended beyond the hunting context and was further established through affiliation to the assembly house (*qargi*) he owned and led.

Surpluses were used both to create a followership that would cooperate for productive activities, as well as to create regional alliances. Crew captains were engaged in some form of competitive feasting, most notably in the Messenger Feast, which took place in winter and included several activities such as athletic competitions, dances, and gift exchange. In the Messenger Feast, as described by Spencer (1959: 210–27), the host *umialik* invited an *umialik* from another community, to whom a great amount of gifts (including food, clothing, equipment, dogs, etc.) were offered. The host *umialik* would accumulate surpluses for this occasion, usually over years, not only with the support of his own followers, but also from other *umialgich* (plural of *umialik*) in his community and their respective followers. By hosting a Messenger Feast and distributing gifts, the *umialik* enhanced his status and created and maintained inter-group alliances.

The patron–client relationship established between an *umialik* and his followership, which needed to be created and constantly maintained through gift giving, greatly resembles the dynamics of big-man leadership in Melanesia described by Sahlins (1963). Moreover, the use of feasting as a strategy to amass and control surpluses produced by others is consistent with Hayden's (1995) depiction of aggrandizers in transegalitarian societies. Feasting may well have been utilized as a strategy to attract labour (Hayden 1995), considering the fact that crew captains competed to attract crew members (especially for specialized positions such as the harpooner), who were free to change their affiliation to a crew (Spencer 1959: 153, 179). In sum, an *umialik*'s leadership depended not only on controlling the means of production but also on controlling labour, which enabled him to accumulate and manage surpluses and to gain higher status and power. His sphere of influence was mainly restricted to the extended family, but the larger his family the wealthier he could become, and the more influence he would have in the community at large (Burch 2006: 74).

Another relevant issue is the relationship between cooperative boat hunting, property rights, and kinship in the emergence of inequalities. 'Eskimo' societies have been generally described as having bilateral kinship with a certain emphasis on the male line or patrilineal links (Damas 1968), but this tendency seems to be stronger and more elaborate in the whaling communities of Northwest Alaska and the Bering Strait region. The Iñupiat had bilateral kindreds but patrilineally focused hunting crews and assembly houses, which acted as corporate groups. Among the Asiatic Yupik of Eastern Siberia and St. Lawrence Island patrilineal clans or lineages corporately owned boats and shared hunting returns, and constituted the basis for recruiting hunting crews (Hughes 1984; Schweitzer 1990). A strikingly similar situation exists among the whale hunters of Lamalera, Indonesia, where patrilineal corporate groups own boats and operate crews with specialized roles and labour; and hunting returns are corporately, if unequally, distributed (Alvard 2003). We may thus speculate that cooperative boat hunting with specialized roles leads to the formation of corporate groups with property rights over technology, and consequently, to unequal access to food and the means to acquire it. The fact that hunting is a male task in the cases discussed above may explain the patrilineal tendency, as a response to the need to maintain a core of closely related males for cooperative hunting (Ellanna 1988), and because unilineal descent creates clearly bounded groups for collective action and the defence of property and people (Alvard 2003).

However, different strategies and organizational forms may be deployed in this respect with consequences on the forms of inequality and leadership. While in the Iñupiat case accumulation of wealth and power by individuals is more prominent, in the other cases mentioned above the corporate group is emphasized. Iñupiaq leadership had elements of both the network and the corporate strategies described by Feinman (1995) or their respective finance and home production strategies in New Guinea depicted by Strathern (1969). On the one hand, the *umialik* was engaged in a network of external exchange through trade with inland groups and through the Messenger Feast (network/finance strategy), and on the other hand, he heavily depended on the labour force of his own group to create and control surpluses in order to create a faction (corporate/home production strategy). The latter was probably more important, since inter-group trade could hardly be monopolized by individuals or groups given its decentralized character in the form of individual trading partnerships (Burch 2005: 62–3), and because most of the material wealth manipulated by leaders took the forms of food surpluses produced by their own group. Interestingly, the Iñupiat did not have unilineal corporate groups in contrast to other transegalitarian (foraging and non-foraging) societies. Instead, patrilineally focused hunting crews and *qargi* affiliation served to create factions that acted as corporate groups, but with the limitation posed by the flexibility and ambiguity of group formation in bilateral kinship systems.

Gender was another, if contentious, aspect of inequality. The existence of certain male dominance among the Iñupiat can be argued on the grounds that marriage could (but not necessarily did) take forms in which women had less freedom of choice, even though they could ultimately refuse to marry a certain man and were also able to initiate divorce as much as men were (Burch 1975; Guemple 1995; Spencer 1959). In the context of the family, Burch (2006: 310) writes that 'males generally had authority over females', but gender intersected for that matters with age, and seniority often had primacy over gender (Bodenhorn 1990: 7; Guemple 1995: 22). On the other hand, women could dispose quite freely of the products of their labour and were able to trade independently from their husbands (Spencer 1959: 177). Being in charge of processing, storage, and distribution, women wielded control over the raw materials and food produced by other members of the family (Burch 2006: 310). Besides, distribution and redistribution 'frequently moved along lines of kinship and affiliation distinct from those of their husbands, sons, or other male kin' (Ellanna & Sherrod 1995: 31). Thus, it appears that women enjoyed high levels of autonomy and had much control over their labour and its products, as well as of part of the family's economic production (Bodenhorn 1990; Ellanna & Sherrod 1995).

Leadership in public domains and politics has been usually described as a male domain in 'Eskimo' societies (for an alternative view see Bodenhorn 1990). For example, Guemple (1995: 25) writes that leaders 'have always been men, and the task of formulating collective opinion and organizing any kind of collective action has invariably been left to them'. This seems to apply to the Iñupiat insofar as the *ataniq* (task-group leader) was generally a male (Burch 2006: 68) and the *umialik* was exclusively male. Thus, even though the distinction between private/domestic and public may not be applicable to foraging societies (Leacock 1978), many collective enterprises such as hunting, warfare, and ceremonies were organized, coordinated and directed by men. Furthermore, the *qargi* – the assembly house and only extra-household institution – has been often translated as the men's house as it was a place where mainly men gathered and women were only allowed to enter for bringing in food and on ceremonial occasions (Ray 1992: 106). Women could wield some informal power through their husbands on decisions that fell into the domain of men (Burch 2006: 308).

But not all leadership was a male matter. As mentioned above, women wielded control over their sphere of production and distribution as much as men did over theirs, and therefore enjoyed much autonomy. Women could be shamans too. Senior women and especially wives of whaling captains had leadership positions in several ritual and economic contexts: they performed rituals to ensure their husband's hunting success, apportioned work among women within the family for processing and storing, controlled caches and supervised distribution within the family, controlled (together with their husbands) inter-family exchange, and dispensed gifts in order to extend influence and create reciprocal obligations (Bodenhorn 1990; Burch 2006; Ellanna & Sherrod 1995). Especially because of the latter, Ellanna & Sherrod (1995) extend Sahlins' model (1963) to Iñupiaq female leaders, arguing that they acted as big-women by using surpluses at hand to create reciprocal obligations through gifts. Indeed, an *umialik* and his wife, whom Bodenhorn (1990) refers to as the whaling couple, acted much as one unit in many of their tasks, responsibilities and functions as leaders.

Changes through contact and assimilation

Before contact with Europeans in the second half of the eighteenth century the Iñupiat obtained some Russian metal (and other) goods through trade with the Chukchi, who received furs in return, which they further traded with the Cossacks. This trade, which continued and increased after contact and through the first half of the nineteenth century (Ray 1992), presumably had an effect on the role of the *umialik*, since controlling trade was to some extent one of the avenues to accumulate wealth and acquire power. This issue may suggest that the Iñupiat in pre-contact times had already been impacted by the European expansion and fur trade before the actual arrival of Europeans, in what Ferguson & Whitehead (1992) have called the tribal zone of expanding states. This points to a limitation in using ethnohistoric reconstructions of Iñupiat society as archaeological analogy for the study of prehistoric transegalitarian societies.

The arrival of commercial whalers and traders to Northwest Alaska in the mid 1800s marked the beginning of intensive interactions with Euro-Americans, bringing large amounts of trade goods, disease, alcohol, and depletion of resources. Many Iñupiat began to work for commercial whalers getting paid with staple foods and trade goods, inducing the movement and concentration of the native population around shore stations (Bockstoce 1978). The possibility to participate in the whaling industry, and make a living out of it, reduced to some extent the dependence on kin, eventually eroding the authority of senior over junior family members. As Burch (1975: 29) puts it: 'By 1885, an Eskimo youth could tell his relatives to 'Go to the devil,' and then join a white man's whaling crew.'

Cassell (2000) describes the consequences of these developments for the leadership of the *umialik*. Strong competition from commercial whalers for recruiting crew members undermined control over labour by already established boat captains. The latter's control over trade was also undermined and new opportunities for accumulating wealth through employment in the whaling industry led to increased numbers of boat captains, such that between the 1850s and 1890s in Barrow the number of captains per person doubled. Thus, Cassell (2000: 115) argues that 'the power base was much more broadly distributed'. At the same time, several Iñupiaq captains ended up operating crews for the commercial whalers, and thus, '[w]here they formerly had controlled production, umialiit [plural of *umialik*] became middlemen' (Cassell 2000: 121).

After its collapse in the early twentieth century, commercial whaling left behind depleted whales and walrus stocks as well as a high dependence of the Iñupiat on imported food and goods, including hunting technology (Bockstoce 1978). Wage employment in the whaling industry was replaced by fur trapping in the North Slope and reindeer herding in the Seward Peninsula, both having the reverse effect of commercial whaling on demography and settlement patterns by dispersing the population (Burch 1975; Chance 1966). Such population dispersals 'disrupted kin ties, winter ceremonials, and other cohesive forms of community life' (Chance 1966: 63), thereby eroding the leadership of the *umialik*. These patterns were again reversed during the 1940s as fur trapping and reindeer herding came to an end. The establishment of missions, stores, schools, and further infrastructure from the 1890s on and the increased possibilities for wage employment led again to a concentration of the population in villages and increased sedentarization, re-establishing the leadership of the *umialik* (Chance 1966: 63–4). In the consequent decades the Iñupiat became widely involved in wage employment such as construction, the military (due to the cold war), and the oil industry (in the North Slope). These historical concentrations and dispersals of the population and their correspondent accentuation or attenuation of the *umialik*'s leadership support the argument that stronger leadership and higher inequality are, at least to some extent, a function of increasing population density, as the costs for leaders to interact with potential followers and other leaders is reduced (Roscoe, this volume).

In the course of the twentieth century political and economic dependence on the United States increased dramatically. Village councils (also tribal councils) were established during the 1930s and 1940s. In 1971 the Alaska Native Claims Settlement Act (ANCSA) was passed and with it village and regional for-profit corporations were created, in which Alaska Natives became shareholders. Contemporary Alaska Native villages have mixed economies combining subsistence hunting, fishing and gathering, with wage labour and cash. At present, there are four sources of cash income in the community of Wales: wage employment, welfare, dividends (from the Native village and regional corporations, as well as from the Alaska Permanent Fund), and some minor commercial activities such as selling ivory carvings. There are limited jobs in the village, provided for example by the airlines (the only way to access the village), the school, the post office, the health clinic, the Native corporation (which owns surrounding land), and the tribal council (funded by the government). The latter is probably the largest employer and the institution in charge of organizing and assisting with funding and subsidies. Many jobs are seasonal and part-time, and costs of living (food, fuel) are high. Cash income is needed for most aspects of survival including food procurement, clothing, housing and heating. Cash is generally not shared in the way wild foods are (i.e. distributed through sharing networks), but is oftentimes pooled by members of a household.

New technologies and dependence on cash altered the organization of hunting crews and attenuated the importance of seniority for leadership. Firearms were adopted already in the late 1800s, outboard motors in the 1920s, and imported boats made of plywood and aluminium were introduced in the 1970s eventually replacing the traditional skin boats. The paths to become a crew captain changed as it became no longer necessary to have access to walrus hides and to women's labour for boat construction, but rather access to cash income. Similar to the effects of commercial whaling in the nineteenth century, this undermined the control of established captains over the means of production and created opportunities for other, and younger, men to buy a boat and form their own crew (Ellanna 1983).

This phenomenon can be observed in some of the five crews that were operating during my fieldwork in Wales in 2016 (see Fig. 5.1), as three of them had younger adults recruiting their older relatives, thus inverting the traditional age hierarchy. Younger captains may now assume the leadership of crews in the traditional way by providing supplies for the hunt, taking important decisions such as when and where to go hunting, assuming responsibilities for the safety of the crew, and taking the risks of unsuccessful hunts. At the same time, senior members in the crew advice younger captains and wield influence on decision making. However, this situation certainly contrasts with the obedience towards senior captains that elderly men in Wales report from their youth, and suggests that decision making and authority in the context of boat crews is now more equally distributed among juniors and seniors.

Captains are generally expected to provide the necessary supplies for hunting, including fuel, ammunition, food, coffee and cigarettes, which represent significant costs ranging from 90 to 300 US-dollars per hunting trip. However, in some cases the captain may not be able to provide all the resources, in which case his family and/or crew members will pool them together. This strategy was pursued by crews with both younger and elder captains, as was for example the case in crews B and C (Fig. 5.1). This seems to be a different situation from the traditional *umialik* who was wealthy enough to provide for his crew and family members, not only during the hunt but also off season, meaning that the present captains might not be as influential and powerful as they used to be.

Moreover, the cash economy has decreased the demand for wild foods, which some households with active hunters reported to eat only one to four times per fortnight. Consequently, some households have become more or less independent from the foraging

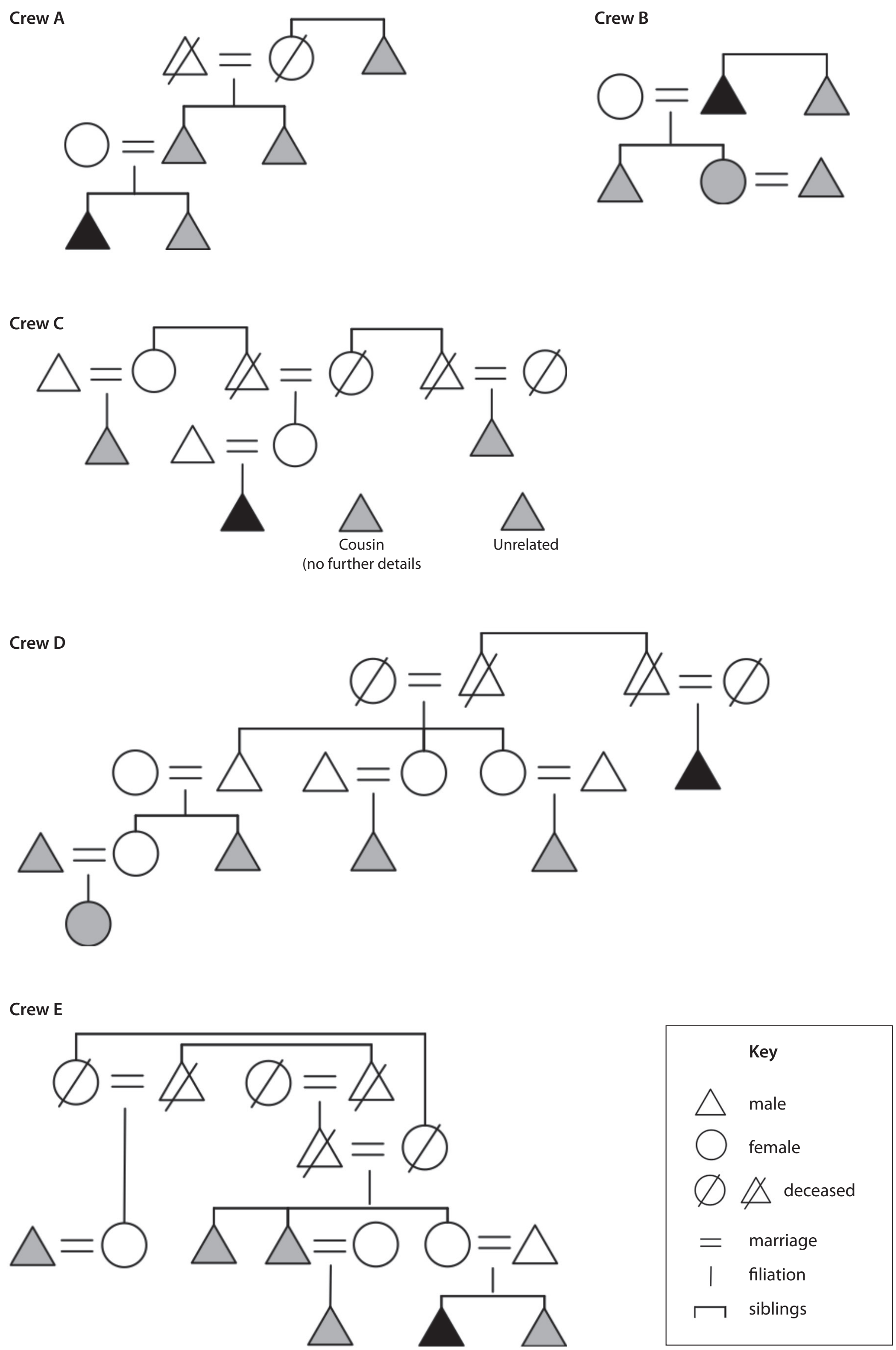

Figure 5.1. *Composition and kinship relationships of five hunting crews in Wales, as surveyed by the author in the spring of 2016. Grey denotes crew members and black crew captains.*

economy. This phenomenon had been already observed by Jorgensen (1990) in his comparison of three Iñupiaq and Yupik villages. Also the use of family-owned caches of food has become less frequent; instead, households tend to store and manage their own food (and other resources) more independently. Shrinking households and family groups (Magdanz, Utermohle, & Wolfe 2002) together with the individualization of production and consumption has reduced the sphere of influence and control of crew captains and their wives, eventually curtailing their authority and leadership.

Technological change and the cash/wage economy has also shifted the patterns of the sexual division of labour. Women's labour has been partly displaced from the foraging economy due to a reduced need for local raw materials formerly processed by women, especially skins for clothing and covering of boats. At the same time, some women go hunting in boat crews (see Fig. 5.1), and some men work with the processing of food, indicating a more flexible division of labour between the sexes. This phenomenon also occurred in the past with labour shortages, now being more likely a response to the reorganization of labour and problems of time allocation due to wage labour. Women appear to be more involved in the wage economy than men (Bodenhorn 1990). They tend to be employed more in white collar jobs, have higher levels of education, work more for wages, and earn more money than men do (Magdanz et al. 2002). In some households women have become the main providers of cash, while men may work seasonally, hunt and take care of children. Women may even finance hunting crews (Ellanna & Sherrod 1995). For example, in some of the crews in Wales it was the mother, wife or daughter of the captain who sometimes or regularly paid for the fuel. Furthermore, Ellanna & Sherrod (1995) observed that particularly powerful women have tended to control the allocation of cash earned by other members of the household. Though women's control of the household economy, especially the processing and distribution of food, is not new, it seems that they may now assume leading roles formerly reserved for men. Women may be heads of households as in some cases observed in my fieldwork, or even become crew captains. One elder and crew captain in Wales expressed his wish to make his daughter and crew member a captain one day. Female harpooners in whaling crews have been reported also among other Iñupiaq villages (Kelkar 2016).

Shifts in the age hierarchy, gender roles, and the relative economic and social importance of hunting, together with changes in political institutions have altered community-wide politics and leadership. When the assembly houses were abandoned or destroyed in the first half of the twentieth century through the influence of missionaries, village councils and other institutions such as the school took over some of the functions of the *qargi* (Larson 1995). Elders in Wales reported that members of the tribal council used to be male elders, usually prestigious hunters and crew captains, who took important decisions, resolved disputes and applied sanctions. However, the tribal council has now become more of an administrative and bureaucratic institution linking the village with state institutions and Native organizations in the urban centres. By the time of my fieldwork most members and employees of the tribal council (including leading positions) and some members of the village corporation were not elder, male hunters, but rather women of various ages, as well as at least one male young adult who did not participate in hunting. While good hunters and boat captains are still prestigious, they are not necessarily wealthy and powerful. Rather, 'the new leadership draws its legitimacy from [formal] education and the ability to interact with external institutions' (Langdon 1986: 39), and this is something for which women are oftentimes better qualified. Regarding seniority, Chance (1966: 64) wrote in his ethnography of North Alaska, that 'the older Eskimo pass on to young adults what was their traditional right to leadership positions' (1966: 64). This is also true for Wales, but it is not without conflict that this process takes place. Elders still have roles as informal leaders, e.g. as elder advisers for the village tribal council, but it is common to hear them complaining about not being heard and taken into account, or not being respected by juniors.

A final issue concerns the changes in the role of kinship and patterns of affiliation. The kinship system and kinship groups were greatly disrupted by epidemics, missionary intervention and the schooling system (e.g. loss of kinship terminology, elimination or repression of certain marriage practices), and the role of kinship in Iñupiaq society decreased through the introduction of wage employment and non-kin organizations and institutions (Burch 1975). Nevertheless, extended family groups can still be recognized in Wales as the main locus for cooperation and exchange, with the difference that now families and households have become smaller (Magdanz et al. 2002). The boat crews in Wales depicted in Figure 5.1 are basically all composed by kin, mostly from within extended families, and they are relatively stable over time, though membership is fluid. However, kinship ties to a captain and crew affiliation does not play a fundamental role in village politics anymore as it formerly did when the institution of the *qargi* was still operating. Contemporary governing institutions do not function according to kinship, but rather through election or employment of their members.

Kinship, however, has not completely lost its political importance, since factionalism in the village still takes the form of family rivalries. But the change in socio-political institutions (i.e. from the *qargi* to the tribal council) implies that now families struggle to control one central, village-wide institution, while formerly each family had its own assembly house. Such is the case in Wales where one family is mainly in control of the village tribal council. This might indicate a tendency towards political inequalities between family groups, rather than between individuals within relatively autonomous families as it formerly was the case. Internal differentiation and the emergence of leading elites through the control of new organizational skills and external links has been reported to occur in other Alaska Native villages (Dombrowski 2007; Langdon 1986). Nevertheless, positions in the village council and the village corporation in Wales seem to rotate often enough among individuals to prevent or dampen this development.

Conclusion

Traditional Iñupiaq leadership was based, to differing extents, on an informal age hierarchy (seniority), organizational skills and knowledge for cooperative hunting, ritual knowledge, a certain gender imbalance, and material wealth inequalities. The latter, in the form of ownership of technology and the accumulation and management of food surpluses as well as trade goods, was the main feature of the *umialgich* – the most prominent Iñupiaq leaders. This distinguished Iñupiaq leadership from that found in egalitarian societies, as it created dependency on specific others and a non-situational, more permanent and institutionalized (though not ascribed) form of leadership. Material wealth was used by leaders to create and maintain a followership as in the model of big-man leadership, with an emphasis on corporate or home production strategies. Despite the lack of unilineal descent groups, affiliation to a hunting crew and a *qargi* (assembly house) served to create factions and corporate groups with a core of patrilineally related males. Even though the *umialik* was always a male, some women (e.g. the *umialik*'s wife) applied similar strategies to become leaders through their own means in the domains of production and distribution over which they had control. Hence, men's and women's leadership was to a great extent heterarchical (Crumley 1995) rather than hierarchical.

Changes in demography, technology, subsistence, and socio-political institutions brought about by contact with Euro–Americans and assimilation into a larger society affected leadership and inequalities in several ways. Concentrations and dispersals of populations respectively strengthened and weakened the leadership of the *umialik*. Imported technologies and changes in subsistence (increased dependence on trade, imported foods and materials, wage labour and cash, and reduced demand of foraging) challenged the traditional age hierarchy and changed the pathways to become an *umialik*. Changes in subsistence also led to an individualization of production and consumption and limited the possibility to generate surpluses through hunting, reducing the sphere of influence of the *umialik* and eroding the traditional big-man type of leadership. Thus status and prestige through large-game hunting became decoupled from wealth and power, and the *umialik* became a more situational leader. Another effect of the changes in technology and subsistence was a shift in the division of labour and consequently in gender roles and inequalities. Finally, the imposition of new governing institutions and the shifts in the skills needed for leadership, together with a reorganization of labour, altered community factionalism and created new leadership patterns in which women and non-hunters take part.

Recent research has paid more attention to individuals and their strategies as driving forces of social inequality. While these are important to account for specific processes and variation, this case study demonstrates that systemic or structural variables must be included as they enable or constrain individual choices and strategies. Based on Ferguson's (1995) revision of Harris' (1979) cultural materialist model, I have elsewhere (Buela 2016) explained historic and contemporary changes in Iñupiaq society as the products of changes in the infrastructure (subsistence, technology and population) as well as the structure (economic, social and political organization) of the social system. While some phenomena can be explained as structural ramifications of infrastructural changes, other have their causes in structural variables. In the present case study, changes of various kinds have been shown to shape the levels and patterns of inequality. Factors such as the availability of surpluses, storage, population density, as well as the relative dependence on foraging and imported food and materials, have enabled or constrained the ability of leaders to become more or less wealthy and powerful. At the same time, the specific forms in which leadership takes place and inequality is organized has depended on structural factors such as property relations, kinship and group affiliation, political institutions, as well as the strategies pursued by individual leaders and corporate groups. Hence, the integration of systemic and actor-centred perspectives can be a fruitful avenue to better understand the dynamics of leadership and social inequality.

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Notes

1. Iñupiat is the plural form and the name of the people. Iñupiaq is the singular form and is used as adjective, e.g. as in Iñupiaq society.

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Chapter 6

Egalitarianism and democratized access to lethal weaponry: a neglected approach

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Many living and ethnographically described hunter-gatherer populations appear to be, in the words of James Woodburn (1982), 'egalitarian societies'; groups among whom 'equalities of power, equalities of wealth and equalities of rank are not merely sought but are, with certain limited exceptions, genuinely realised' (p. 432). An early colonial account of the Tanzanian Hadza (Bagshawe 1925: 123), for example, observed that they 'recognise no chief or headman'; a fact reflected in recent accounts (Marlowe 2010; Blurton Jones 2016). Similarly, Kirk Endicott (1988: 122), quoting Woodburn (1982), wrote of the Malay Batek people that 'there are either no leaders at all or leaders who are very elaborately constrained to prevent them from exercising authority or using their influence to acquire wealth or prestige'. Many other forager groups have comparably flat political hierarchies, including the Central African Mbuti (Turnbull 1964: 41; 'There are no chiefs or councils of elders') and Aka (Bahuchet 1999: 192; 'There is no constraining political hierarchy… Aka society is acephalous'); the Philippine Agta (Griffin & Griffin 1999: 292; 'no one has control over another person') and, though perhaps to a lesser extent, the Dobe Ju/'hoansi (Lee 1979: 348; 'Each one of us is headman over himself!'). This pattern of political egalitarianism is often associated with low population densities, high residential mobility and variable group composition, and little to no territoriality (Kelly 2013; Roscoe, this volume).

Of course, as with any reductionist attempt at typifying societies, the reality is more complex. For example, among some Australian groups such as the Tiwi, inequalities in prestige and influence are recorded in the absence of formal political hierarchies and alongside egalitarian food access (Hart & Pilling 1960). These groups would not be classified as 'egalitarian societies' *sensu stricto*, but even among more egalitarian groups, differences in status are still found. For example, among the Hadza, people are aware of inequalities in the hunting ability of their campmates (Stibbard-Hawkes et al. 2018). Good hunters are viewed favourably (Wood 2006) and camps often take their name from 'some senior man, usually between 40 and 65 years of age' (Marlowe 2010: 49). The Ju/'hoansi, although they emphasized sharing and downplayed status differences, recognized priority of access rights over the areas surrounding water holes ('n!ores'), and the groups living near particular watering holes were often given the name of a single person (e.g. 'Bon!a's camp' or 'Kxarun!a's camp'; Lee 1979: 343).

Furthermore, as Flanagan (1989) observed, so-called 'egalitarian societies' often have a strong sexual division of labour, where men and women pursue different, non-overlapping sets of resources (see also Bird 1999; Marlowe 2007). Although many egalitarian societies may have a high degree of female autonomy (Endicott 1981; Dyble et al. 2015), there still often exist inequalities between the genders. Among the Hadza, for example, women are more often the victims of domestic violence (Marlowe 2015, pers. comm.). However, though gender inequalities do exist among residentially mobile foragers, they still appear in a large number of cases to be less marked than among other populations (Endicott 1981).

Despite the difficulties involved in classifying differing groups using a single term, the extent of individual autonomy, and equality in resource access among many forager groups is remarkable, especially in contrast to the inequalities in status, property and wealth so ubiquitous in most other human populations. It is also remarkable that egalitarianism is so often found among residentially mobile, small-scale forager groups who have no phylogenetic or other link beyond sharing a notionally similar subsistence strategy.

Although those 'egalitarian societies' discussed by Woodburn (1982) are all hunter-gatherers, not all hunter-gatherers – those groups who subsist without plant cultivation or domesticated livestock – are egalitarian. Among many Australian foragers, for example, although there are no formal political hierarchies and few inequalities in food access, certain individuals may be senior to others and there are significant inequalities in men's marriage prospects accompanying significant differences in individual autonomy between the sexes (Hart & Pilling 1960; Martin 1999). Further, many hunter-gatherer groups, for example those living on the Pacific Northwest coast of North America (e.g. the Chinook) formerly had social stratification, hereditary 'castes', and discrepancies in wealth (Ames 2003; Hajda 2005). Some groups held slaves (Ames 2003). Such status differences were also observed, though to a lesser extent, among the Chumash people of California (Arnold 1992) and among several New Guinean groups (Roscoe, this volume). Patterns of storage, wealth and status differentiation are also visible archaeologically in several past hunter-gatherer populations, including several prehistoric North American groups (Arnold 1992; Sassaman 2004) and those of Jōmon period Japan (Arnold 1992). In this latter case, there is some disagreement about the extent of inequalities observed in grave goods (Pearson 2007), a problem exacerbated by the fact that the 'Jōmon' period (14,000–300 BC) is broadly defined and neither resource use nor demography were temporally or spatially homogeneous (Crema et al. 2016).

Such hierarchies are generally found in the contexts of storage and sedentarism, especially in areas where resources are clumped and monopolizable (e.g. fishing weirs or fertile stretches of coast; Kelly 2013: 255) and/or are temporally desynchronized, necessitating storage (e.g. anadromously breeding fish & seasonal nuts; Testart et al. 1982; Arnold 1992; Cannon & Yang 2006; Sakaguchi 2009). In this view, storage accompanies sedentism – stores cannot be abandoned – and reliable year-round food access. This leads to population growth, which further reduces residential mobility (Kelly 2013), prohibiting people from relocating to avoid would-be despots. Population size increases also require increased intensification of labour and so 'leaders arise as a product of the need to coordinate communal labor and alleviate the stress on group members of punishing free-riders' (Kelly 2013: 267). Alternatively, viewed in terms of Marx's theory of alienation, storage creates surplus which, if monopolized by a minority of individuals, can be leveraged as capital either to pay other individuals to generate and defend more surplus, or to invest into 'heavy and non-transportable equipment for food processing [production] and food storage' (Testart et al. 1982: 525) which generate greater individual wealth for resource holders. Although the specific mechanisms are complex, multifaceted and not widely agreed upon, the general prediction is clear: Storage and sedentism are 'the "kick" that sets sociopolitical changes in motion' (Kelly 2013: 252) and precipitate a shift from 'simple', mobile, egalitarian forager groups to 'complex' hierarchical societies.

This logic, although coherent, carries several assumptions (see Rowley-Conwy 2001) of which I highlight two. The first is that modern mobile, egalitarian forager groups make good models for past forager societies. This assumption has been discussed at length elsewhere. It is made difficult firstly because the political organization of many contemporary foragers has been seen by some as a product of state interactions (e.g. Wilmsen et al. 1990; Headland et al. 1989; Lieberman et al. 2007) and because many forager groups in Australia, especially in coastal regions (Martin 1999) have strong gerontocratic hierarchies, even without storage and sedentism (Myers 1999). However, although there are problems with this view, it is one that I, like others (e.g. Lee 1998; Layton 2001; Marlowe 2005) generally support. In the words of Robert Layton (2001: 314–15), 'I consider the tendency for hunter-gatherers with very different histories to converge on particular solutions to living in certain environments… insightful in understanding the role of hunting and gathering in human evolution'.

The second assumption is the almost Rousseauian notion that egalitarianism is the ancestral condition of mankind, and that the appearance of storage, sedentism and the advent of agriculture or food storage, initiated a shift towards inequality and hierarchy (Testart et al. 1982; Kelly 2013). This assumption is reflected in the title of the present volume; even to ask whether we can 'speak of inequality before farming' is to assume ancestral egalitarianism.

However, if we look beyond the human species, to gregarious primates and other group living mammals, we regularly find hierarchy and profound inequality in resource (food and mate) access. Chimpanzees (*Pan troglodytes*), for example, have dominance hierarchies which influence both resource access (Murray et al. 2007) and, among males, number of offspring sired (Constable et al. 2001). Male bonobos (*Pan paniscus*), although less often violent and less male-dominated than *Pan troglodytes*, also form linear dominance hierarchies both in captivity (Vervaecke et al. 2000, though see Paoli et al. 2006) and the wild (Surbeck et al. 2011). If we assume, as many have done (McGrew 2010), that the last common ancestor of humans and *Pan* was more *Pan*-like than human-like (Wrangham 1987; McGrew 2010), we take human egalitarianism to be a derived condition. If egalitarianism was widespread among earlier hominins, it must have appeared at some point during the last 4–8 million years (Hobolth et al. 2007;

Langergraber et al. 2012). Knauft et al. (1991), discussing violence, describe this as a 'U-shaped curve'. Equality, in this view, was absent throughout most of our evolutionary history, appeared at some point, and then disappeared again with the advent of storage and sedentism. If this is the case we need not only to explain why egalitarianism disappeared. We must also explain how it appeared and was regulated in the first place.

There have been several attempts to do this. Boehm et al. (1993) have argued that egalitarianism is the consequence of an egalitarian 'ethos', where individuals who become over-assertive or self-aggrandizing are subject to criticism and ridicule ('Any San who tries for personal ascendency is quickly cut down…;' p. 230) and are deliberately disobeyed. Gardner (1991: 457) advances a similar argument and calls this ethos 'individual autonomy syndrome'. Suzman (2017a,b) has also recently advanced this view and highlighted the importance of 'bushman banter' in maintaining egalitarianism. Although among many forager groups people will vociferously complain if someone is seen to be taking more than their share (see, for example, Peterson 1993), this is a proximate explanation (see Bateson & Laland 2013) and does not explain how complainants enforce their claims or why non-egalitarian groups do not have a similar ethos.

Woodburn (1982) has, among other things, stressed the importance of mobility and the fact that, where individuals can move between locations freely, interpersonal relationships 'do not involve long-term binding commitments' (p. 434) and, moreover, mobility allows 'people to segregate themselves easily from those with whom they are in conflict' (p. 435) and avoid would-be despots.

Several authors have also stressed the importance of food resource access and distribution in maintaining egalitarianism. Kristen Hawkes (2000) has argued that the unpredictability and high daily variance in individual hunting success rate typical of many hunter-gatherer groups 'undercuts hierarchy' (p. 59). 'Any hunter's success on one day will always be followed by failures, limiting the extent to which anyone can maintain superiority over others' (p. 72).

Further, hunted game are seldom temporally clumped and are, therefore, difficult for particular individuals to monopolize. As consequence 'people are not dependent on specific other people for access to basic requirements' (Woodburn 1982: 434). This idea has been expressed in terms of Marxian theory (Winterhalder 2001) – or what Lee (1990), quoting Engels (2010), refers to as 'primitive communism'. By this logic 'the environment itself [acts as] the storehouse' (Lee & DeVore 1968: 11–12), no one individual can control surplus and 'the whole population retain[s] access to the means of production' (Lee 1990: 254). I call this the 'meals-on-legs' hypothesis, though elsewhere in the literature 'foraging-mode-of-production theory' is preferred (Gardner 1991: 453–4). This hypothesis is similar to and compatible with the idea that hierarchy is related to storage, sedentism and the monopolization of defendable resources (Testart et al. 1982; Kelly 2013).

These ideas have been reviewed elsewhere and, with the exception of the two 'resource distribution' explanations for egalitarianism which I return to in the conclusion, I discuss them no further. One specific idea, that egalitarianism is related to democratized access to the means of coercion (Woodburn 1982), especially lethal ranged weaponry (Bingham 2000), is discussed only occasionally in the literature. Here I hope to demonstrate that this idea is compelling, especially when considered in the context of the literature concerning animal hierarchies.

In this chapter I first provide a brief and selective overview of A) the patterning and consequences of hierarchy amongst non-human animals and B) the reasons why hierarchies and inequalities between individuals are so widely observed among non-human group living-mammals. In doing so, I hope to demonstrate that forager egalitarianism is unusual when considered in an evolutionary perspective, and to show that the phenomenon probably followed a 'U-shaped curve'. Second, and drawing on this logic, I explore the hypothesis that forager egalitarianism is related to the appearance of lethal weaponry and poisons. I argue that this idea is compelling when considered in the context of animal hierarchies. Finally, I explain why the idea is difficult to test in both ethnographic and archaeological contexts.

I conclude that the resource distribution hypothesis is more compatible with the available evidence, although argue that the two theories are not necessarily mutually exclusive. The fact that many non-egalitarian groups also have widespread access to lethal weaponry, discussed in the conclusion, appears problematic to the theory, although I propose that the lethal weapons hypothesis is yet compelling and may still serve as an important mechanism within contexts where valuable resources such as land or cattle are not monopolized. I argue that a more systematic analysis of the ethnographic record is warranted.

The patterning and logic of hierarchy in group living mammals

Group living among animals carries with it many advantages. In most species, group living reduces predation. In some species, individuals may actively deter predators through group defence and mobbing

(Russell & Wright 2009; Gursky 2010). More broadly applicable is the fact that 1) when grouped with other individuals, the risk to the individual of being targeted is reduced (Hamilton 1971), and 2) groups have many more eyes and ears, increasing the speed of predator detection, while also decreasing the individual cost of anti-predator vigilance (Mooring et al. 2004; Davies et al. 2012). Group living may also facilitate defence of resources (Wrangham 1980; Bryant & Grant 1995), cooperative foraging (Creel & Creel 1995; Boesch 2002; Carbone et al. 2005) and information transfer (de Groot 1980; Wilkinson 1992)

The disadvantage of group living is that individuals are often thrust into competition with conspecifics over both food resources and, more often among males, who generally have a higher potential reproductive rate (Clutton-Brock & Vincent 1991; Clutton-Brock & Parker 1992), mate access. Such disputes are seldom settled equitably. When in direct competition over mates or food, many gregarious animal species have 'dominance hierarchies', where less dominant individuals defer to those individuals higher up the 'pecking order'. This is not always the case and when resource distribution presents few opportunities for direct contest competition, as among predominantly folivorous female mountain gorillas (*Gorilla gorilla berengei*; Watts 1994), hierarchies may be flat or may not be seen. However, where animal hierarchies are found, they often have profound consequences to the health, nutrition and reproductive success of individuals living within groups.

These consequences are often most clear in male-mating competition and in numerous species, for example mandrills, macaques, langurs and fallow deer (de Ruiter & van Hooff 1993; Dixson et al. 1993; Launhardt et al. 2001; Say et al. 2003) it is not uncommon for the male at the top of the hierarchy to sire ≥60 per cent of a group's offspring in any given year. In species such as gorillas, the majority of other males may be ejected from groups altogether (Robbins 1999). The effects of hierarchy are also plainly seen in feeding competition. For example, a study of Kenyan baboons (*Papio anubis*) revealed that the highest ranking three females ate 30 per cent more food than the three at the bottom of the hierarchy (Barton & Whiten 1993). Similarly, at Gombe national park, low ranking female chimpanzees (*Pan troglodytes*) foraged in a smaller area than higher ranking females, especially during times of food scarcity (Murray et al. 2007). These differences in food access may translate directly into fertility, as is observed among low-ranking females in numerous group living primates, including macaques, baboons, geladas, grivets and others (Harcourt 1987). In species with more stable hierarchies, low-ranking individuals may also experience more stress and disease (Sapolsky 2005). In certain species such as meerkats (*Suricata suricatta*), which live in relatively harsh environments and can seldom successfully migrate from their groups as lone breeding pairs, the majority of low-ranking females may not reproduce (MacLeod et al. 2013), and higher-ranking females may attack or evict those conspecifics with whom reproductive competition is most likely (Young et al. 2006).

Animal dominance hierarchies are epiphenomena: the emergent properties of multiple individual-level, usually dyadic, interactions, each probabilistically in the interest of both parties. Indeed, when constructing a hierarchy, researchers generally measure dyadic 'displacements' or 'feeding supplants', or other dyadic cues such as fear or greeting vocalizations (Wittig & Boesch 2003; Fedigan & Bergstrom 2010). The hierarchy, which is not necessarily stable, is the final ranked order of which individuals defer to which others.

The basic logic of such dyadic interactions, set out clearly by Kaufmann (1983: 3), is simple. 'It is usually advantageous for both individuals to recognize and abide by an established, relatively peaceful dominant-subordinate relationship. This saves both individuals time, energy, and the risk of injury. In addition, the dominant presumably gains immediate priority of access to contested resources. Usually the subordinate, who would probably lose in combat anyway, is better off to bide its time until able to compete from a position of greater relative strength'. Potentially fatal fighting is only worthwhile when 'a major part of a contestant's lifetime reproductive success is at stake' (Enquist & Leimar 1990: 1)

This idea has been modelled game-theoretically, using a simple dyadic 'Hawk-Dove' game (see Maynard Smith & Price 1973; Enquist & Leimar 1990; Matsumura & Kobayashi 1998; Matsumura 1999). In these models, after an initial 'display', individuals take turns and may either escalate and continue fighting until injured or the opponent retreats ('Hawks'), may retreat if the opponent escalates ('Doves') or may escalate and then mirror their opponent ('Retaliators'). Two further variables are then adjusted; the win probabilities of the competing individuals and the severity of injury relative to the value of the resource over which they are competing. As demonstrated by Matsumura & Kobayashi (1998), and assuming complete information, where the severity of injury is much greater than resource value and/or there are large asymmetries between the win probabilities of two individuals in a dyadic contest, Dove/Hawk or Hawk/Dove strategies are evolutionarily stable. In these cases, the individual with the lower chance of winning should play the dove strategy and the one with the higher chance of winning should play the hawk strategy. 'Egalitarian' retaliator/retaliator strategies, where neither individual escalates, also become evolutionarily stable, alongside Dove/Hawk & Hawk/Dove strategies, where the win probabilities are more even. Of course, individuals do not always have complete information and so should use cues such as body size, ritualized displays, or, at greater cost, with an initial contest, before choosing which strategy to adopt (Hammerstein 1981; Parker & Rubenstein 1981; Setchell & Wickings 2005).

As is implied by these models, dominance relationships are often initially 'determined, especially among strangers of approximately the same size and sex, by fighting. [Or are] determined by a mutual assessment of each other's likelihood of winning a serious fight… [through] recognition of differences in size, age, etc' (Kaufmann 1983: 3). Signals or cues may be used in assessment of fighting ability such as croak depth in European toads (*Bufo bufo*; Davies & Halliday 1978) and perhaps snout, rump and genitalia colouration among male mandrills (*Mandrillus sphinx*; Setchell & Wickings 2005).

There are several further complications. Fighting ability/resource holding potential can change greatly throughout an individual's lifetime due, for example, to disease, senility and injury, leading to changing dominance relationships (Matsumura & Kobayashi 1998). In certain taxa such as baboons, random acts of aggression may be employed by dominant individuals to suppress increases in resource holding potential among subordinates (Silk 2002). Furthermore, dominance interactions are not necessarily dyadic and coalitionary support may modulate dominance relations in some taxa. For example, it has been proposed that, where individuals can rely on coalitionary support from a parent, dominance ranks may be parentally inherited, as observed among female rhesus macaques (*Macaca mulatta*; Berman 1980). Changing and unstable alliances may lead to rapidly shifting hierarchies. The killing, in 2011, by a group of three lower ranking males, of the alpha male of a Mahale chimpanzee community (Kaburu et al. 2013) provides a good anecdotal example of this phenomenon in group-living apes. Finally, inclusive fitness may play a role and, where relatedness is high, individuals, rather than competing, may even subsidize the reproduction of close relatives at cost to their own direct fitness (Sherman et al. 1995).

Despite these complications, the basic logic of animal contest remains clear and explains why 'despotism' and dominance hierarchies are so frequently observed in nature. Numerous human forager groups, characterized by wide redistribution of foraged food (Gurven 2004), low male and female reproductive skew (Marlowe 2005; Marlowe & Berbesque 2012) and relatively few inequalities in status (Woodburn 1982) appear as outliers and do not, *prima facie*, seem to fit the logic of animal dominance interactions. In the following section, I propose that, when human lethal weaponry is considered in the context of the literature on animal dominance interactions, egalitarianism should be expected.

Egalitarianism by method of mutually assured destruction: the levelling effects of democratized access to lethal weaponry

Lethal weapons in ethnographic context

Forager hunting technologies and toolkits vary considerably across the globe, as do hunting strategies. In the words of Marlowe (2005) 'There are horse-mounted, bow-and-arrow hunters of bison, harpoon hunters of walrus who travel in kayaks, salmon weir-fishers, and spear, blowgun, and net hunters'. Most ethnographically described residentially mobile foragers, however, have one element of technology in common; they are possessed of long-ranged, projectile weapons which can be used to kill at a distance, are possible to make from freely available materials, and often employed in conjunction with potentially lethal poisons.

The most well known of these is probably the bow and arrow. Bows are composed of tensile 'string' tied to both ends of an 'arc' of pliable wood. Arrows of wood and usually with feather stabilizers (fletching) and whittled to a point or fixed with an arrow head, are fitted to the bowstring with a notch at the base. They have an effective range of *c.* 26 metres (Churchill 1993).

I am most familiar with Hadza hunting technology, described here. Almost every male Hadza over the age of 5–6 years has a bow (*ko'o*) (Marlowe 2010: 84; Crittenden et al. 2013). Adult bows are a mean 154 cm in length and mean peak pull strength is between 61.61 pounds (27.94 kg) (Stibbard-Hawkes et al. 2018) and 69.4 pounds (31 kg) (Marlowe 2010). Bows are made from appropriately sized tree-branches, usually of *Grewia spp.* or *Dombeya kiriki* (Bartram Jr 1997; Marlowe 2010), which are first cut from the tree and roughly shaped with an axe, then whittled with a knife (Fig. 6.1). Today, bows are usually strung with commercially produced rope though strings were traditionally made from the nuchal ligament of a large quadruped (Bagshawe 1925; Woodburn 1970). Hadza arrows come in several types, either wooden (usually *Grewia spp.*), tipped (pointed/barbed) or fitted with a wooden or iron arrowhead (Woodburn 1970; Marlowe 2010). Iron arrow-heads are made with scraps of iron or traded iron nails. Finally, the Hadza habitually use two types

Figure 6.1. *A Hadza man whittling a bow.*

of poison, *panjube* and *shanjo*. Both are plant-based, *panjube* extracted from the branches of *Adenium obesum* and *shanjo* from the seeds of *Strophanthus eminii* (Marlowe 2010: 89). Both act on the heart and induce fatal cardiac arrest (Bartram Jr 1997). *Panjube*, about which more is known, will kill within 20 minutes and 5 hours depending on the strength and dose of the poison and the size of the animal (Bradfield et al. 2015) or within a couple of minutes if hit directly in the heart or intestines (Marlowe 2010: 89).

Numerous other groups employ bows and poisoned arrows. Several San-speaking populations including the Ju/'hoansi and Hai||om employ hunting bows in conjunction with poisons made variously from plants (*Adenium spp.*) and larvae (e.g. *Diamphidia spp.*) (Chaboo et al. 2016). The Agta of Luzon in the Philippines also employ barbed arrow points and occasionally also poisons (Griffin 1997). Bows and arrows, with or without poisons are or were also used by the Mbuti of central Africa (Turnbull 1964), the Okiek of East Africa (Kratz 2014), the Aché of Paraguay (Walker et al. 2002), the Andamanese (Radcliffe-Brown 2013) and many other groups worldwide.

The second most widely occurring ranged weapon type is the spear-thrower, named the 'atlatl' in American or 'woomera' in Australian contexts. Both operate similarly. They consist of a wooden shaft, with either a hook, spur or cup, which is used to secure a wooden 'dart' or 'spear'. This spear may be sharpened or hafted with a stone, bone or metal point, much like an arrowhead. The shaft provides leverage, which allows the dart to be thrown to an effective range of *c*. 39 m (Churchill 1993). Spear throwers were used in most parts of North, West and Central Australia, though less commonly in the South and East (see Fig. 6.2; Davidson 1936). Bows were never used in Australia and nor could I find any mention, in any ethnographic literature, of poisoned weapons there. Spear throwers, sometimes in association with poisons, are or were also used by numerous populations in the Arctic and in North, Central and South America, though in most cases such groups also used bows (see Grund 2017, for a brief but thorough review).

There are two further notable weapon types, poisoned blowguns and handspears. Blowguns or blowpipes consist of a long (0.46–7 m) tube of drilled or hollowed wood or naturally hollow bamboo or reed (Jett 1970). These are sometimes made from a single tube, and sometimes composites with an inner tube and attached outer-tube (Jett 1970). In Borneo, wooden blowguns may be fitted with a spearhead to act as dual-purpose weapons, although this type is not found elsewhere (Jett 1970). Exhaling sharply into the pipe propels darts of clay or, more usually, sharpened/splintered wood or bamboo, sometimes with fletching. The efficacy of these darts is entirely dependent on the use of poisons, which vary regionally in type and origin. In the Old World blowguns were used widely by hunter-gatherer groups in south East Asia (Fig. 6.3) including Malaysia, Indonesia, South India and Madagascar (Jett 1970; Endicott 1979). Blowguns are also found in much of Central America, the north of the South American continent and the southeast of the North American continent (Fig. 6.4). Remarkably, their use in Madagascar (Jett 1970) and the American tropics (Jett 1991) appear both to be cases of diffusion from Southeast Asia. Blowguns provide greater precision in poison delivery than other weapon types, though leave shallower wounds. They are thus most effective on smaller prey and are usually used to hunt arboreal species (Endicott 1979). For example, in the Batek case blowguns are predominantly used on bamboo rats, bats, birds (Endicott 1979) and small primates.

Hand spears are found throughout the world in conjunction with other weapon types and, where the above technologies are absent, as in parts of Australia (Davidson 1936) hand spears may be used exclusively. These very simple weapons are made of a single piece of wood sharpened to a point, and of variable length. They may be thrown. Two Australian populations,

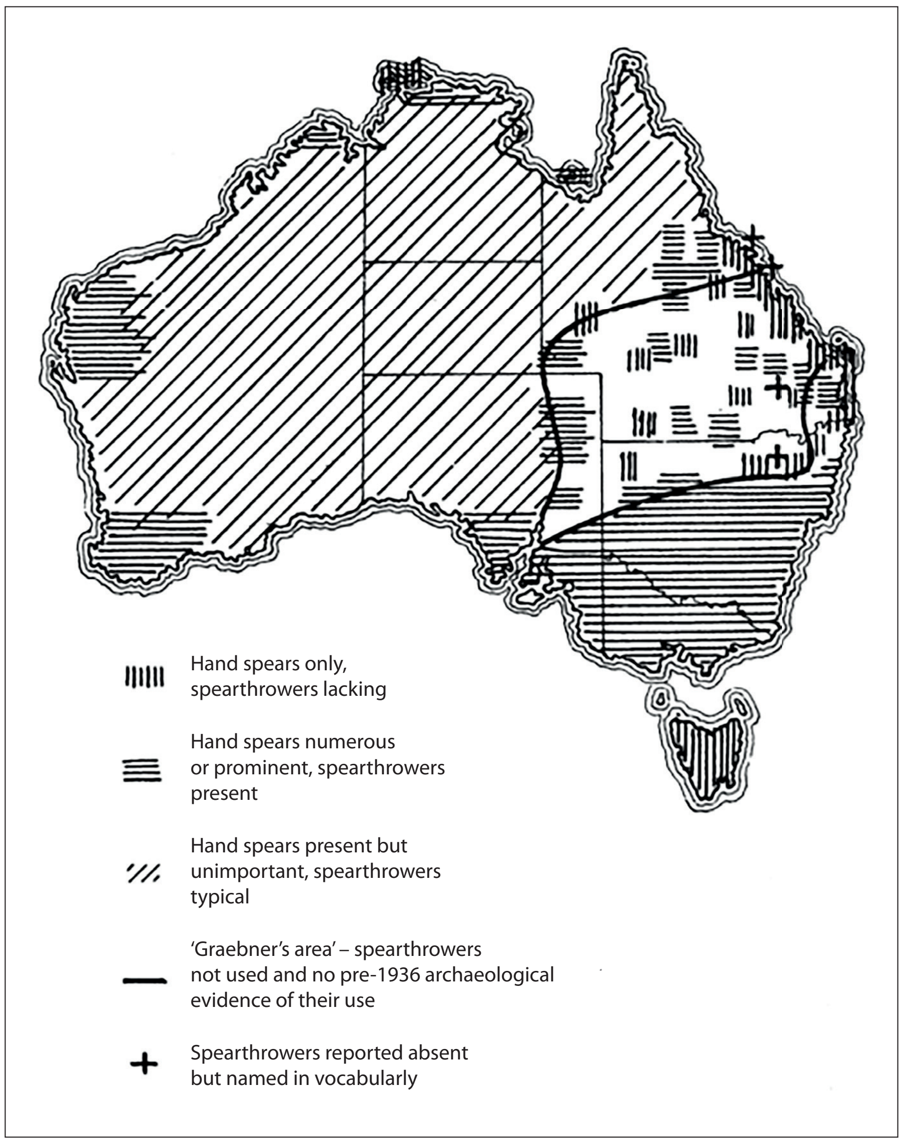

Figure 6.2. *A map of the distribution of hand spears and spearthrowers throughout Australia, adapted from Davidson (1936).*

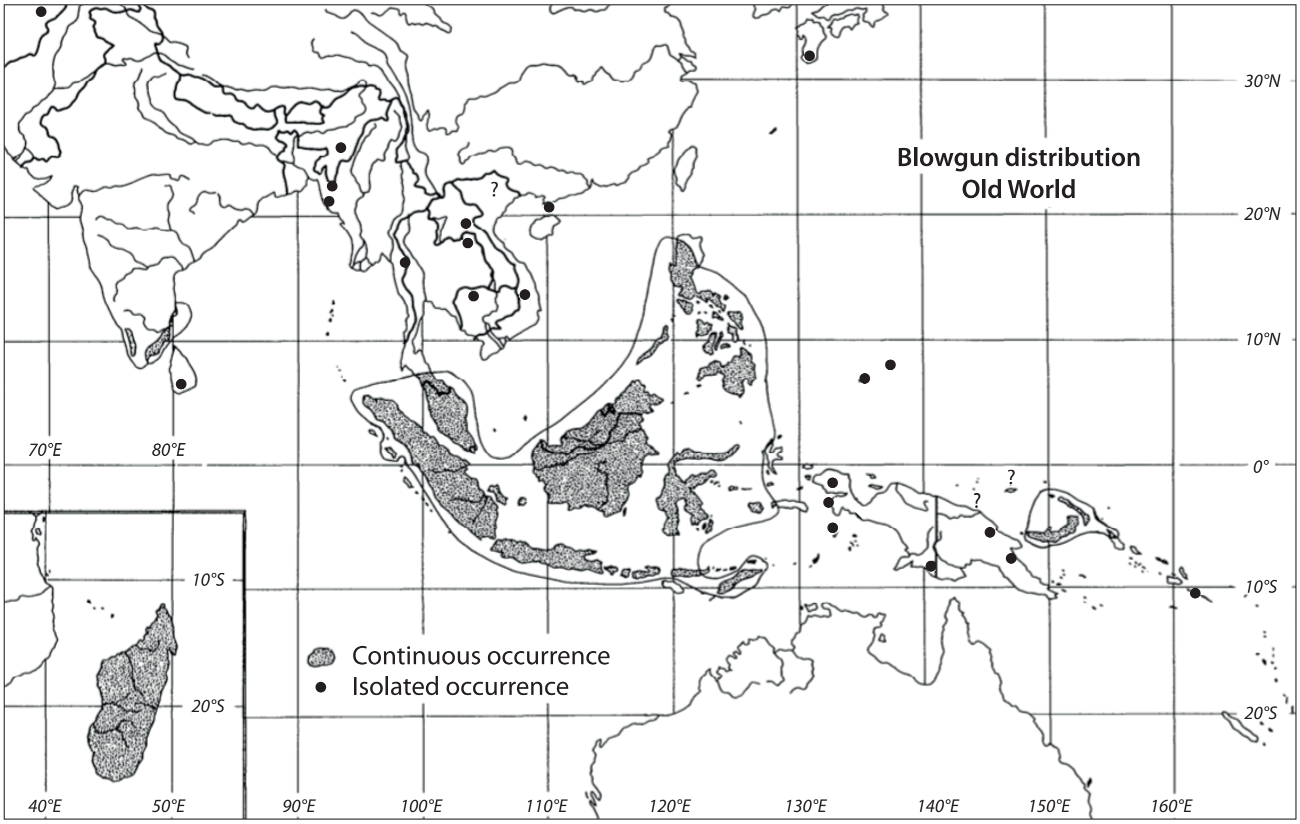

Figure 6.3. *A map of the recent historic distribution of blowdart use throughout the Old World, reprinted with permission from Jett (1991). Occurrences in Egypt and Europe not shown.*

the Tiwi and the Tasmanians, used throwing-spears in hunting (Churchill 1993). Hand-thrown spears, though of a larger calibre than spear-thrower projectiles, are effective at shorter distances than bows and spear-throwers (*c*. 6–8 m) (Churchill & Rhodes 2009).

Lethal weapons as a levelling mechanism

These weapons, bows and arrows, spear-throwers, blowpipes and hand spears, have five key commonalities. First, they can be used at a distance, and where there is no immediate risk of injury from any target that is not similarly equipped with an equivalently powerful ranged weapon. Second, in most cases a clean shot will be either immediately or eventually fatal, especially where potent poisons are used. Third, all have the potential to be immediately lethal in ambush contexts. Fourth, although all require some specialized knowledge to make and use, they can be made from materials that are freely available to all individuals. Fifth, although these are hunting weapons, they are also similarly effective against people.

The outcome, as James Woodburn (1982: 436) put well, is that: ‘In normal circumstances the possession by all men, however physically weak, cowardly, unskilled or socially inept, of the means to kill secretly [or easily] anyone perceived as a threat to their own well-being not only limits predation and exploitation; it also acts directly as a powerful levelling mechanism’.

Put more directly in terms of animal dominance contests, democratized access to lethal weaponry has two main impacts. First, democratized access to lethal weaponry greatly flattens inequalities in fighting ability between individuals. Providing they are not too young or senile to use a bow, this is true regardless of differences in age, strength or condition. Second, the chance of fatal injury involved in even short altercations is dramatically increased; while an individual may take repeated bites, blows or scratches and live to fight again, a weapon wound may easily result in death. These are exactly the two key parameters included in Matsumura & Kobayashi’s (1998) game-theoretical model of dominance interactions. Not coincidentally, it was in these conditions that, in Matsumura & Kobayashi’s model, the ‘egalitarian’ strategy, among others, became evolutionarily stable.

Using different variables, and framed in the context of cooperation, not dominance relations, the lethal weapons hypothesis has been recently modelled by Phillips et al. (2014) using an iterated prisoner's dilemma game. Assuming that non-cooperators were more likely to enter disputes, Phillips et al. (2014) showed that, where such disputes were likely to be lethal, non-cooperative strategies, perhaps unsurprisingly, were far less successful. This article has received lamentably little attention with six citations at the time of writing.

A variant of the lethal weapons hypothesis has been proposed by Bingham (2000). Here, again, the idea is framed in the context of cooperation rather than hierarchy. Bingham argued that ranged weaponry and the capacity to kill at range facilitated coalitionary punishment by allowing 'many animals to attack a target animal simultaneously' (p. 250). In doing so, ranged weapons substantially decrease the risks of injury to an individual punisher. This, in turn, allows humans solve collective action problems by penalizing 'free-riders' at minimal personal cost.

Another variant of the lethal weaponry hypothesis has also been applied directly to animal dominance relationships. Female lions (*Panthera leo*) have highly egalitarian social relationships and relatively low levels of reproductive skew (Packer et al. 2001). Feeding supplants are rare 'and there is no discernible feeding hierarchy among females' (p. 691). Furthermore, mothers 'voluntarily' contribute to communal cub

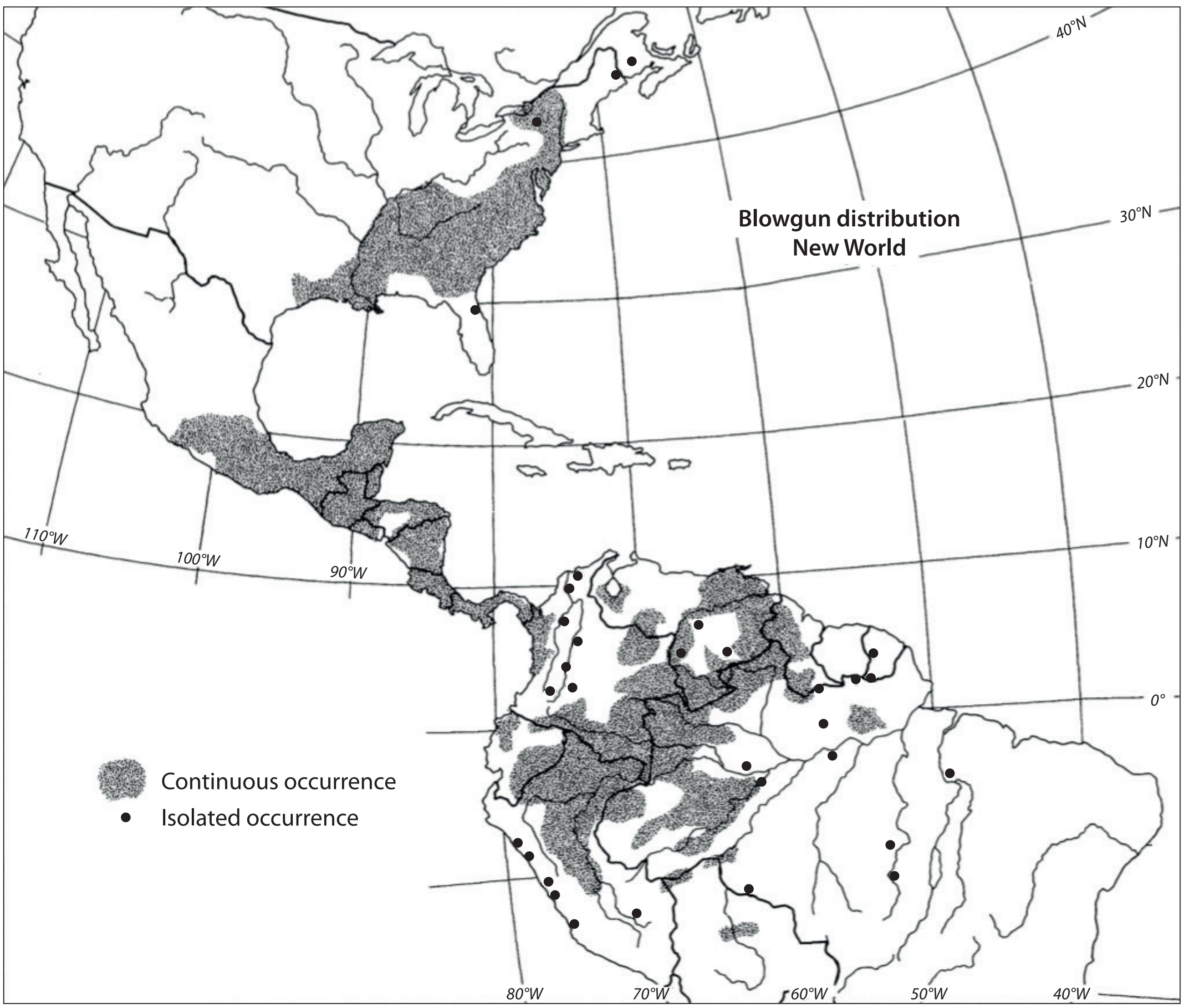

Figure 6.4. *A map of the recent historic distribution of blowdart use throughout the Americas, reprinted with permission from Jett (1991). All occurrences ethnographic, except the Peruvian coast, which is archaeological.*

rearing. Packer et al. (2001) have argued that this phenomenon may in part be due to the fact that fighting among lions, who are well adapted carnivores, is unusually costly. Such 'extensive weaponry carries a greater risk of "mutually assured destruction" than in other social species' (p. 691). However, here there are some complications. Firstly, lions are cooperative hunters and habitually rely on peer support in securing resources, a fact which Packer et al. (2001) also argue plays a contributing role in maintaining egalitarianism. Second, male lions, although they may cooperate, exhibit profound reproductive inequalities (Packer & Pusey 1982); the lethality of male intra-sex altercations does nothing to prevent this, perhaps because of the high value of mating access.

The phrase 'mutually assured destruction' is familiar from the logic of 'nuclear deterrence'; the idea that, when neither belligerent in a war can expect to survive an all-out attack, it is rational for neither to escalate hostilities. This has been cited as the reason why the cold war of 1947–91 between the Eastern and Western Blocs never resulted in direct and open conflict. A compelling counter argument is that, individually, people and governments are not reliably rational entities and can and do make illogical decisions. For this reason, the nuclear deterrent, even if effective, should not be relied upon as a sensible long-term strategy for maintaining peace. In an evolutionary timeframe however, it is not necessary that all individuals act rationally all the time. It is only necessary that altercations are sufficiently deleterious as to be selected against. And indeed, there is much evidence from forager groups that interpersonal violence with weaponry, although rare, regularly does result in fatal injury. For example Woodburn (1982: 436) reports that Hadza 'recognise the danger of public violence' and (Marlowe 2010: 141) reports 'Men are slow to anger, but… can quickly kill with poisoned arrows. All murders I am aware of, except one… were committed by men, and all were apparently disputes over women (jealousy).' Despite the lethality of the bow, the Hadza murder rate is estimated at only 6.6 per 100,000 people Marlowe (2010: 141). For this reason, I argue that lethal weaponry does act as both a deterrent to, and a significant selection pressure against attempts to take more than one's share or exercise control over others. The result is, put in Hobbesian terms, a cold war 'of every man against every man' or, framed in Rousseauian terms, liberty, egalitarianism, autonomy and freedom from despotism.

Variants of the 'lethal weapons hypothesis' are proposed or alluded to by several other scholars. Darmangeat (2016) has argued that male monopolization of lethal weaponry might facilitate male control over women. Grund (2017) makes a similar argument, proposing that bows, which have a steeper learning curve than atlatl and, thus, a higher barrier for proficiency, preclude women, who are afforded less time to practise, from effectively using hunting weapons. This, Grund argues, leads to greater social disparity between the genders. This logic does not hold in the Hadza case – women do not often in practice learn to make or use weapons and yet are afforded almost complete autonomy in where they live and who they marry, yet may hold in other contexts (Deaner & Smith 2013; Grund 2017). Darwin (1871), Wolpoff et al. (1976) and Wrangham & Peterson (1996), although not directly discussing hierarchy, have suggested that reductions in canine size sexual dimorphism throughout hominin evolutionary history may be due to their replacement by extra-somatic weapons. Boehm (2009), although he places great emphasis on ethos, also argues that assassination, homicide and the 'elimination of upstarts' may be one way of maintaining egalitarianism, and discusses the lethal weapons hypothesis directly with special reference to Kalahari foragers (pp. 174–81). Finally, the lethal weapons hypothesis was also pivotal to a recent theoretical review of the origins of human political systems (Gintis et al. 2015).

Expectations of the hypothesis and the difficulty of testing

This lethal weaponry hypothesis of egalitarianism is simple, and generates a single, elegant prediction: society level inequalities in resource access should be inversely related to A) the extent of democratized access to and B) the lethality of weapons. Of further consideration, and in concordance with models from the animal literature (Matsumura & Kobayashi 1998), the seriousness of injury ought also to be relative to the value of the contested resource, and so the hypothesis is perhaps more fruitfully tested in forager groups where land and other valuable resources are not monopolized. Despite the simplicity of these prediction, they are so difficult to test using available ethnographic and archaeological datasets as to be practically non-falsifiable.

Testing in ethnographic context

Testing the lethal weapons hypothesis among ethnographic forager populations is difficult for two reasons. First, the majority of forager groups are possessed of similarly lethal weapons. The bow is widespread among hunter-gatherer groups outside Australia and, where not found, the spear-thrower usually is (see Churchill, 1993). In circumstances where neither were used, such as traditionally amongst the aboriginal people of Tasmania (Oswalt 1976: 263–4) or Southern Australia (Davidson 1936), individuals still had access to handheld spears which, although not affording the safety of distance, yet probably still decreased discrepancies between individual fighting ability and increased the lethality of fights. Where there exists little variation, cross-sectional, correlative statistical hypothesis testing is not possible.

This problem is compounded by the fact that none of the significant cross-cultural datasets, *the Ethnographic Atlas/Standard Cross Cultural Sample* (Murdock & White 1969), Binford's 2001 *Frames of Reference* dataset nor the Human Relations Area File, provide good, tabulated descriptions of ranged weapons technology. Binford's database[1] contains no tabulated information on weapons technology. The SCCS does provide two 'weapons/ammunition' variables (V1044/V1065) but these are binary, 'present/absent' data, and most cases are missing.[2] It may be possible to build a database with materials from the HRAF, although this project is beyond the scope of the current work. Furthermore, in exploratory searches of the HRAF[3] and literature searches more broadly, it appears that ethnographic accounts of poison use are especially limited and superficial. Cross-cultural hypothesis testing among hunter-gatherer groups is rendered even more problematic by small sample sizes, a problem exacerbated by the necessity of phylogenetic correction, with its accompanying information loss. Though cross-cultural reviews of forager weapons technology do exist, those I have found either focus in specific detail on the hunting technologies of a limited number of groups and do not provide a broad, cross-cultural sweep (see Knecht 1997) or do not provide readily tabulated ethnographic data (Churchill 1993)

To further test the lethal weapons hypothesis, and the associated idea that gendered inequalities in lethal weapons access are related to power disparities between the genders, it would be worthwhile to build a good, cross-cultural ethnographic database of weapons technology, coding the ease of use, ease of access and potential lethality of different weapons types. Of further importance is the distribution and efficacy of different poisons which greatly increase weapon lethality. As Bartram Jr (1997: 337) put well, among African foragers, the bow is more important as a 'poison delivery system' than a weapon in its own right. Furthermore, poisons seem not to be used on the Australian continent where many foragers have non-egalitarian gerontocratic systems of status differentiation, often in association with high levels of polygyny (e.g. Hart & Pilling 1960). It would be further interesting to look closely at the Australian ethnographic evidence, to see whether there existed systematic differences in inequality between those groups who predominantly used the spear-thrower and those who used the handheld spear or shorter-ranged throwing spear (see Fig. 6.2).

An initial search revealed that much of the ethnographic literature on hunting technology is 'scattered, and highly variable in its thoroughness' (Jett 1970: 622) and not readily available online or in most British libraries. Furthermore, ethnographic accounts of poison appear, in my literature searches, especially limited. To build such a database would be a significant undertaking. Furthermore even if a good, cross-cultural database were constructed, lack of variation and the problem of phylogenetic correction might both pose difficulties. However, such a project may yet be a fruitful avenue for further research.

Testing in archaeological context

Given the difficulties involved in testing the hypothesis cross-culturally, it is next sensible to look to the archaeological record. Here, again, there are difficulties.

It can be difficult to find evidence of hierarchy in the deep past. In the context of farmers and so-called 'complex' foragers, grave goods and settlement patterns (Binford 2001) may be used to identify social distinction. I make three comments on this. Firstly, such methods are contentious and, when grave goods and settlement patterns are available, data may be open to multiple interpretations (e.g. Pearson 2007). Secondly, and more importantly, such data only appear within the last 16,000 years, and cannot be used for testing the 'lethal weapons hypothesis' across hominin evolutionary history. Third, the hypothesis is more fruitfully tested in the absence of valuable monopolizable resources. In mobile forager groups with few personal possessions, differences in hierarchy and autonomy between groups would be effectively invisible and if, indeed, foragers in the deep past were similar in the extent of their egalitarianism to those described in the ethnographic literature, this would leave no discernible trace.

One possible solution, specifically in the context of inequalities in reproductive skew, is to look at sexual dimorphism between hominin species. In many extant primate species, body and canine size dimorphism appears a reliable proxy measure of the extent of direct male-male competition and reproductive skew (Plavcan & Van Schaik 1997), although the extent to which behaviour in past populations can be reconstructed using such methods is debated (Plavcan et al. 2005). Low male reproductive skew is not equivalent to egalitarianism, though it may tell us something about the extent of inequality in male dominance relationships. Hominin evolution is indeed characterized by

Table 6.1. *Body weight dimorphism in Hominoidea and fossil hominins (estimated), adapted from McHenry (2005), with dates from Klein (2009).*

Species	Male body size (kg)	Female body size (kg)	Ratio	Age (ma)
A. afarensis	44.6	29.3	1.5	3.8–2.9
A. africanus	40.8	30.2	1.4	3.0–2.4
A. boisei	48.6	34.0	1.3	2.3–1.4
A. robostus	40.2	31.9	1.2	1.8–1.4
H. habilis sensu stricto	37.0	31.5	1.2	2.3–1.6
H. rudolfensis	59.6	50.8	1.2	2.4–1.8
Early African *H. erectus/ergaster*	62.7	52.3	1.2	1.8–0.7
H. neanderthalensis	60.1	51.8	1.2	0.5–0.3
H. sapiens	64.9	53.2	1.2	Extant
P. troglodytes	54.2	39.7	1.4	Extant
P. paniscus	47.8	33.1	1.4	Extant
G. gorilla	157.9	75.4	2.1	Extant
P. pygmaeus	78.8 (Morph II)	38.8	2.0	Extant
H. syndactylus	11.3	11.2	1.0	Extant
H. lar	5.5	5.2	1.1	Extant

decreasing sexual dimorphism (Table 6.1). Canine size and estimated body weight dimorphism among australopithecine species were greater than in modern humans, though lower than those of gorillas (McHenry 1992; Plavcan & Van Schaik 1997). *Homo erectus*, *H. rudolfensis* and *H. neanderthalensis* had sexual body size dimorphism equivalent to *H. sapiens* (McHenry 2005), meaning that modern human levels of sexual dimorphism appeared in the hominin lineage around 2.4 ma.

Evidence for lethal weaponry is much more recent. The best evidence for projectile weapons comes in the form of small stone bladelets (microliths) with one edge blunted (backed), presumably to facilitate hafting, that are the correct size and shape to have been used in conjunction with a weapon delivery system 'most likely in the form of spear-thrower-delivered darts' (Churchill & Rhodes 2009: 201). The earliest backed microliths come from Pinnacle Point, South Africa, dated to *c.* 71,000 years ago (Brown et al. 2012). Similar backed microliths appear later at a number of other sites in eastern and southern Africa including Howiesons Poort, South Africa, between 60–65 ka (Jacobs et al. 2008), the Naisiusiu Beds at Olduvai Gorge, Tanzania between 42 and 62 ka (Skinner et al. 2003) and Mumba Cave, Tanzania, at *c.* 57 ka (Gliganic et al. 2012). Outside Africa, evidence of long-range, high-velocity projectile weapons is found at Ksar Akil, Lebanon, and El Wad, Israel, both dated to between 40–50 ka (Shea 2006; Churchill & Rhodes 2009). The earliest uncontested evidence of the bow[4] dates to only 11 ka from Stellmoor, Germany (Cattelain 1997), although at Sibudu Cave, South Africa, several conical bone points, similar in shape to those used by southern African Bushmen, have been found dating to before 61 ka (Backwell et al. 2008). Poisons are even more difficult to reliably identify in the archaeological record, although *Podocarpus* (a genus of poisonous conifer) resin identified on two microliths at Sibudu, South Africa dated to *c.* 65 and *c.* 62 ka may represent their earliest known use (Wadley et al. 2015). Other potential candidates include beeswax laced with *Euphorbia sp.* at Border Cave, South Africa and dated to *c.* 40 ka (D'Errico et al. 2012) or a potential poison applicator stick at the same site dated to *c.* 24 ka and containing *Ricinus sp. (*D'Errico et al. 2012).

Spears, thrown or handheld, have a longer history. The earliest uncontested evidence of spear use comes from Schöningen, Germany, where eight perfectly preserved wooden spears were found dating to between 300–400 ka (Thieme 1997; Villa & Lenoir 2009). It is unclear whether these were handheld or thrown (Sahle et al. 2013). 'Rifling marks' on a horse scapula from Boxgrove, England, and dated to 500 ka (Roberts 1998) provide the earliest good evidence of throwing spears, although it is assumed, based on the proportion of large fallow deer in faunal assemblages at Gesher Benot Ya'aqov in Israel that hominins must have used hunting weapons by at least 800 ka (Rabinovich et al. 2008).

As far as is known then, the appearance of weapons technology in the archaeological record postdated the appearance of human-like sexual dimorphism in the hominin lineage. Mechanically projected weapons appear recently, and are not associated with evidence for increased egalitarianism. Spears, although of far greater antiquity, can only be seen >1 ma after the appearance of modern human patterns of sexual dimorphism.

This venture is complicated greatly by taphonomic concerns. Most weapons can be built entirely without lithics, metals or any other archaeologically visible material as regularly happens in ethnographic context (e.g. Marlowe 2010). Indeed, Waguespack et al. (2009) have shown experimentally that there are very few advantages to using stone-tipped over wooden arrows. Atlatl, blowguns, throwing spears and associated poisons are often made with entirely biodegradable materials. Spears – in their most basic form sharpened branches – are similarly impossible to detect and are probably simpler to manufacture than the knapped stone Oldowan and Lomekwian lithic industries that appear in the archaeological record at 2.6 ma (Semaw et al. 1997) and 3.3 ma (Harmand et al. 2015) respectively. Indeed, spear-like probing sticks are used in the hunting of bushbabies (*Galago senegalensis*) by chimpanzees (Pruetz & Bertolani 2007; Pruetz et al. 2015). Therefore, and although the best interpretation of the current evidence fails to support the lethal weapons hypothesis, the archaeological record is effectively silent on this issue, and it is possible that spears have a far greater antiquity than the current evidence suggests.

Conclusions: a tantalizing possibility, though less compelling than resource distribution

There are further issues, even more problematic for the lethal weapons hypothesis, at least in non-forager contexts. The first is that many groups, especially pastoralists and horticulturalists, have both democratized access to lethal weaponry and high reproductive skew and inequalities in property ownership. For example, Tanzanian Datoga pastoralists regularly carry bows and yet have high rates of polygyny (Muller et al. 2009) and inequalities in property ownership. Democratized access to weapons in tandem with inequalities in resource access and status are frequently observed among other pastoralists such as the East African Maasai, among non-egalitarian hunter-gatherers such as the Chinook (Hajda 2005) and also among many forager-horticulturalists such as the New Guinean Garisakang (Konečná & Urlacher 2017). Furthermore, in the present-day USA, guns, though regulated, are more easily available than elsewhere in the world. Here such access to lethal weaponry is found in association with profound inequalities in wealth and status, and has not flattened hierarchies, although the presence of a powerful state perhaps limits the relevance of this example.

Here, in both cases, inequalities seem unrelated to access to lethal weaponry. What horticulturalists and pastoralists do have, which many nomadic foragers don't, is personal property and highly defensible and monopolizable resources – livestock or land. And, indeed, reliance on and defence of monopolizable resources, even with democratized access to lethal weapons, is in numerous contexts related to inequalities in health, status and, especially for males, high reproductive skew (Kelly 2013; Powers & Lehmann 2014; Mattison et al. 2016). Ready access to lethal weaponry does not have a levelling affect in these contexts. For this reason, the 'resource distribution' hypotheses considered above – especially the 'forager mode of production' theory (Lee 1990) and those related theories which highlight the roles of sedentism and storage (Testart et al. 1982; Kelly 2013) or the defensibility of transmittable wealth (Mattison et al. 2016) - are greatly more consistent with the cross-cultural ethnographic and archaeological evidence.

Further, I have so far emphasized that the lethal weaponry hypothesis is compatible with the literature on animal dominance relations. And this is true. However, the resource distribution hypotheses are similarly consistent with animal socio-ecology. Although the explanatory power of environmental variables in shaping primate social relations has recently been critiqued (Thierry 2008; Clutton-Brock & Janson 2012), differences in the defensibility of food resources have been many times convincingly related to the patterning of hierarchical relationships in different primate species. Hierarchies are more despotic when resources are more easily monopolized, more egalitarian when resources are dispersed (Sterck et al. 1997). Archaeologists, including other authors in this volume, are justified in continuing to search for relationships between resource use, storage, sedentarism and inequality. And this is not inconsistent with Matsumura & Kobayashi's models of dominance animal relations, which assesses the potential risk involved in competitions, *relative to the value of the contested resource*.

It is apparent then, that this 'lethal weapons hypothesis', if it does hold explanatory power, is surely only one of many significant mechanisms which allow egalitarianism to be maintained. Lethal weapons do not appear to foster equality in groups with property, storage and perimeter defence, where the value of held resources is high relative to the risk of injury, and where resources may be effectively cooperatively defended. However, in more limited contexts, especially where high-value monopolizable resources such as arable land, cattle or fishing weirs are not found, the idea may still hold explanatory power. It may go some way towards explaining why hierarchies are generally flatter and resource access more equal among many human foragers than among other group-living animals. Indeed, it would be surprising if the invention of lethal extra-somatic weapons did not have some effect on dominance relations. Moreover, the hypothesis is neglected. As argued, a tabulated overview of diversity in weapons technology in the ethnographic record would be valuable. Particular consideration should be paid to poisons which greatly increase weapon lethality (Bartram Jr 1997) and are not universally found nor, to the author's knowledge, recorded in Australia. It is possible that the results of such research would not support the hypothesis. Regardless, and despite the problems highlighted here, I contend that through modelling, cross-cultural comparison or closer analysis of the archaeological record, the lethal weapons hypothesis yet merits further scholarly attention and consideration.

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Notes

1. R-Repository from https://github.com/benmarwick/binford accessed on 4 May 2018.
2. R-Repository from http://eclectic.ss.uci.edu/ drwhite/worldcul/world.htm, accessed on 4 May 2018.
3. http://ehrafworldcultures.yale.edu accessed on 4 May 2018.
4. Since this chapter was written, further evidence has been published of early bow and arrow use at both Klasies River Mouth, South Africa >60 ka (Bradfield et al. 2020) and Fa-Hien Lena, Sri Lanka *c.* 48 ka (Langley et al. 2020).

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Chapter 7

Adaptation and cumulative processes in human prehistory

Robert H. Layton

The paper argues for a synthesis of Darwinian and Marxist theories of evolution. It is based partly on two previous papers: Layton & Rowley-Conwy (2013) and Layton (2005). The argument that hunter-gatherer societies evolve via a natural progression from simple to complex is still sometimes defended (Rousseau 2006). Here, I argue instead that hunter-gatherer social strategies are adaptations to specifiable ecological conditions (Darwin), but also that social strategies have emergent consequences which shape the political structure of hunter-gatherer society (Marx) (see Fitzhugh 2000: 107–8; Layton 2000: 111–19). Ecology can create an envelope in which various social strategies may be in play but, over time, the evolutionarily stable strategy will be the one that gives actors the optimum return under prevailing ecological and social conditions.

Marx and progressive evolution

While the notion of evolution as progress – from simple to complex, from superstition to rationality – was pre-eminent in nineteenth century thinking, Marx differed from other nineteenth century evolutionists in identifying the mechanisms by which human social differentiation occurred. Adam Smith had argued that self-interested market exchange generated universal opulence (Smith 1976 [1776]: 22), but Marx (1930 [1867]) showed how the internal dynamic of industrial capitalism created ever increasing social inequity. He found the driving force of social instability in the capacity of human beings to produce, by their own labour, more than they needed to subsist. In *Capital* (1930 [1867]), Marx argues that simple economies are characterized by direct exchange between producers. It was this type of exchange that Smith (1976: 27) described in his famous dictum, 'It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own self-interest'. One commodity is exchanged for another of equal value and goods are valued in terms of their usefulness to the owner (Marx 1930: 87ff). The germ of capitalism lies in the origin of a new concept of exchange, in which the aim is to make a profit. The value of a good in exchange comes to dominate over its use value.

Co-operation versus competition: co-evolution as a potential synthesis

The unit of selection in Darwinian evolution is the individual. Darwin (1859) was interested in competition between individuals of the same species because this is where competition for food is most intense, so adaptation in social behaviour (co-operation, reciprocity) within a species was beyond the scope of his argument. He did, however, notice that 'hive bees' pollinate one species of clover, but 'humble bees' pollinate another. From this, he deduced that each species of bee was visiting the species of clover in which the arrangement of stamens and pistils was most suited to the habits of that insect. Similarly, individuals in a species of bee with slight differences in the length or curvature of the proboscis might be able to obtain their food more efficiently than others. 'Thus (he wrote) I can understand how a flower and a bee might slowly become, either simultaneously or one after another, modified and adapted to each other in the most perfect manner' (Darwin 1886 [1859]: 75), a process now known as co-evolution. Darwin's example recalls Adam Smith's image of the butcher, brewer and the baker, each satisfying their own needs by providing resources to others. The Red Queen hypothesis has a more Marxist flavour. The Red Queen hypothesis (van Valen 1973) models the co-evolution of predator and prey: in any generation, only the faster cheetahs will capture enough gazelles to feed their young, and only the faster gazelles will escape to raise *their* young, creating a spiral of ever more specialized adaptation. In biology, the types of interaction between individual pairs of species identified by Darwin and van Valen have been generalized in the concept of a 'fitness landscape'; a complex system in which every organism and every population is a part of the environment exercising selective pressures on, and being influenced by, the other species with which it interacts (Kauffman 1993: 181).

I propose that the phenomenon of co-evolution in an ecological or social system offers a potential synthesis of the Marxist and Darwinian approaches. The principle of co-evolution integrates the concept of the self-interested individual with the emergent properties of interaction. Two theories have been proposed to explain the evolution of co-operation among animals of the same species. Hamilton's (1964) theory of kin selection is most applicable among social insects. Where all the ants or bees in a colony are produced by the same queen, they will all be half siblings. If one dies to save others the 'altruistic' gene will be perpetuated in many of its half-siblings. Among humans and other mammals Trivers' (1985) theory of reciprocal altruism generally carries more weight, because it does not depend on close genetic kinship to make social behaviour adaptive. Reciprocal altruism depends on mutual trust within a continuing social relationship. Hunter-gatherer bands provide an ideal forum for this kind of interaction.

Game theory provided a break-through in the study of social interaction. The aim of game theory is to show what will happen if particular social strategies are played against themselves and others, in order to measure the costs and benefits for the players. Maynard Smith termed the strategy that wins against itself and all other existing strategies being played in that field of interaction, an evolutionarily stable strategy (Maynard Smith 1982: 10). Strategies may be evolutionarily stable in one environment, but not in another.

Reciprocal altruism occurs when individual A helps individual B on the understanding that if A needs help at a later date, B will provide it. It can become an evolutionarily stable strategy where there is a risk of hunger, and where it is impossible to predict which individual will be successful in obtaining food on any one occasion, yet those who are successful get more than their immediate need. When the once-successful individual is unsuccessful on another occasion, the debt can be repaid and a relationship of mutual trust built up. Co-operation or reciprocity will only be adaptive if the benefits to each participant are greater than if each individual acted selfishly alone, and it can only succeed when A knows he/she has an on-going social relationship with B, which demonstrates that B is trustworthy. Reciprocal altruism provides an important strategy for coping with unsynchronized foraging success in hunter-gatherer communities and acts as a levelling mechanism that promotes egalitarianism within bands.

Theory applied to hunter-gatherer societies

Price and Brown (1985) cited four types of archaeological evidence for the process they term 'intensification'

- increasing technological specialization
- reduced mobility and larger settlements
- boundary defence of territories
- differentiation of social rank

These criteria correspond quite closely to Woodburn's (1982) category of *delayed return* hunter-gatherer societies, as opposed to his *immediate return* egalitarian hunter-gatherers. Price and Brown's approach would implicitly treat Woodburn's 'immediate return' societies as a sort of null point, whereas one of Woodburn's best known achievements was to demonstrate that egalitarianism is deliberately contrived by members of the community. I disagree, however, with Woodburn's (1980: 101) contention that egalitarian societies can function under any environmental conditions. I will argue that egalitarian societies arise where it is in participants' best interests to practice the kind of social strategies whose consequence is to generate egalitarianism.

In the following section I explore the extent to which hunter-gatherer complexity ('intensification') can be explained as a suite of adaptations to specific ecological conditions

- Sharing vs storage can be explained as social adaptations to the extent to which seasonal resource availability is predictable or not. If seasonal resource availability is predictable, storage can be adaptive. If not, sharing may be a more successfully strategy.
- Following Torrence (1983; 2001) I point out that complex technology is associated with highly seasonal environments in which hunting predominates over gathering (see Torrence 2001: figs. 4.1 and 4.2).
- Territoriality is associated with environments in which resources are sufficiently densely and predictably distributed to repay the cost of defending them (among animals as well as humans – Davies & Houston 1984; Dyson-Hudson & Smith 1978).
- These conditions are all found in higher latitude temperate environments, but 'delayed return'

conflates at least two axes of variation (Layton 2005: 140): technology and territoriality.

As Ben Fitzhugh (2003: 14) writes, 'Explaining the evolution of complex hunter-gatherers becomes a matter of identifying the ecological (social and physical) conditions under which self-interested individuals would find it most advantageous to compete for status [and], attempt to control or amass resources.'

Storage vs sharing

Evolutionary anthropologists have devoted much research to investigating reasons why it might be adaptive for the hunter to give away part or all of his prey (see Stibbard-Hawkes 2017 for a critical review). Winterhalder (1987) provided a testable model: a hunter-gatherer band containing six hunters, who all go hunting independently. Each one is only successful one day out of six; but no-one knows when they will succeed. If the one who is successful shares his catch with the others each evening, every family will always have enough to eat. Among the Ache of South America a family of four could only make use of 50–60 per cent of the calories provided by a single peccary before it rotted, so it is more efficient to share the surplus (Kaplan et al. 1990: 114; Kaplan & Hill 1985: 237). The success of the hunter's strategy of sharing depends on reciprocal altruism; he will only benefit if he receives a share of another hunter's catch on a subsequent day when he himself is unsuccessful. As Winterhalder (1987) explained, this strategy is adaptive in a stochastic environment, where success in hunting is unpredictable and varies from hunter to hunter on any particular day. In a highly seasonal environment, where glut and shortage are predictable and effect everyone equally it is more adaptive to store part of the glut and retrieve it during the season of shortage.

Technology

Hunter-gatherer technology is subject to two conflicting adaptive pressures, precision versus flexibility. Precision demands that specific implements be designed to achieve particular tasks efficiently, while flexibility encourages multi-purpose tools that can exploit a wide range of more or less unexpected encounters. Optimal strategies are those that give the greatest return for least effort: in any ecological setting there will be 'trade-offs' between conflicting goals, such as design for specific tasks versus multi-functionality, tools made 'on the spot' and those carefully looked after. The optimal solution will depend on the local environment.

Two of Torrence's examples (see the larger comparative tables in Torrence 1983: figs. 3.1 and 3.2) dramatically illustrate the difference between low and high latitude tool kits.

	weapons	*instruments*
Arrente (Central Australia)	4 (21 parts)	4 (7 parts)
Taremuit (Arctic)	18 (133 parts)	1 (3 parts)

Torrence explains the difference as a response to two related factors. In high latitudes plant foods are scarce and meat makes up a larger proportion of the diet. Animals, however, are more difficult to catch and, particularly when each species is locally available for only a short period, it pays to have effective weapons. Due to their technology Woodburn classified 'some' Inuit as delayed return societies. Arctic Inuit society was nonetheless traditionally egalitarian, like recent low-latitude hunter-gatherers, because of the high level of unpredictable daily risk in the Arctic. Co-operation in seal hunting, for example, was necessary because each seal kept several breathing holes open and each had to be guarded. This co-operation evened out individual hunting success.

Mobility and territoriality

The ability to move between bands is fundamental to human hunter-gatherer behaviour, especially in resource-poor environments. Movement may serve several purposes. The band territory rarely enables self-sufficiency in subsistence resources. Woodburn (1982) argued that the desire to avoid disputes and overbearing would-be leaders were the main reasons for movement between bands among the Hadza. Turnbull and Abruzzi both reached the same conclusion with regard to movement between Mbuti bands (Turnbull 1965: 106, 223; Abruzzi 1980). Equalizing band size may also be an underlying consideration. There are echoes here of Marx's 'Primitive Communalism' but, rather than supporting the concept of an 'original human condition', the evidence again points to egalitarianism as the outcome of social strategies that are adaptive in particular ecological conditions.

Pooling of resources does not cease simply because, as Rousseau (2006) argued, people suddenly find it irksome to have to share, but because in certain ecological circumstances it no longer works to their advantage in the long run. Claiming exclusive access over territories is most profitable when resources are densely and evenly distributed, but in sufficiently short supply to make it worthwhile competing for them (Dyson-Hudson & Smith 1978; Gould 1982). Among recent hunter-gatherers boundary defence was most emphatically practiced on the Northwest Coast of North America. As resources become more unpredictable, however, it becomes increasingly less certain that the individual or group will be repaid for defending the territory and defence eventually becomes uneconomic. As resources become scarcer, an increasingly large territory would be needed to guarantee self-sufficiency. These constraints arise in both low-latitude semi-arid and arctic environments. Cashdan was the first to point out that low-latitude hunter-gatherers generally adapt to this constraint by allowing the kind of inter-access described by Lee, Turnbull and others rather than abandoning territoriality altogether (Cashdan 1983). Peterson (1975) and Cashdan called this 'social boundary defence', that is, defending access to the social group that holds the territory.

Social boundary defence generates equality between bands that allow each other access to their 'territories', and here again a Marxist approach provides additional insight into the emergent social consequences of human adaptive strategies. Woodburn rightly regards the ability to change camps as a vital way of preventing the emergence of overbearing leaders, and therefore integral to the egalitarianism characteristic of 'immediate return' societies. Reciprocal exchange is supported by the egalitarian principle that surplus resources should be shared rather than hoarded. When all hunter-gatherer bands in a region suffer equally from uncertainty as to future resource distribution, and the risk of local resource failure is unsynchronized, permitting mutual access to temporary abundances is a way of insuring against starvation. If one band's territory experiences better rainfall than neighbours, it will benefit the band to allow other bands to share its windfall, *providing* those bands in turn allow their former hosts to camp with them when the unpredictable sequence of rainfall favours the former guests (Smith 1988; Winterhalder 1990: 67). Other bands must ask permission before they share your resources, as this acknowledges the debt (Lee 1979: 336; Turnbull 1965: 96).

Inequality and the breakdown of reciprocal altruism

Woodburn (1980: 101) wrote that the differences between immediate and delayed return societies could not be explained by simple environmental factors. My original aim in constructing the four-cell diagram (Fig. 7.1, from Layton 2005: 140) was to show that once 'delayed return' among hunter-gatherers was disaggregated into two axes it became easier to demonstrate correlations with ecology. Low seasonal variation was associated with simple technology and immediate consumption, while high seasonal variation was associated with complex technology and storage. 'Flexible' patterns of territoriality, i.e. mutual rights of access to neighbouring territories, were associated with the absence of unilineal descent groups, whereas claims to exclusive access were associated with descent

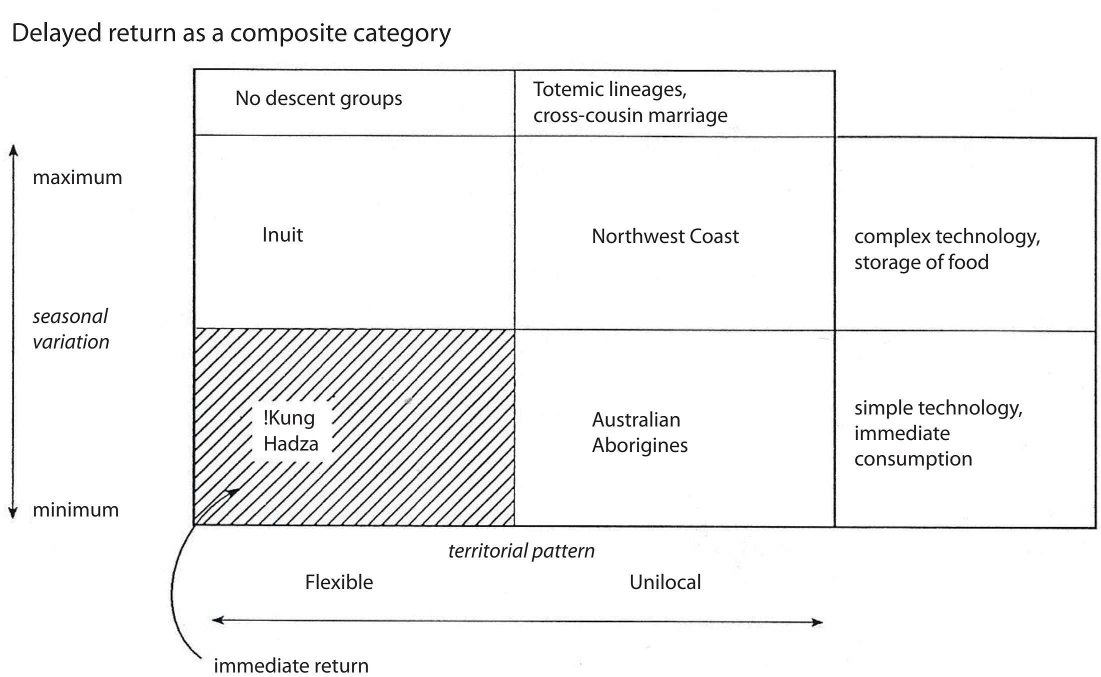

Figure 7.1. *Delayed return as a composite category (from Layton 2005: 140).*

groups. Including North Australian Aboriginal societies in the latter category, I pointed out that in Australia, as a consequence of unpredictable variation in resource availability, exclusive access was limited to sacred sites and the right to wear body paintings identifying the dancer with the group's totemic ancestor. On the Northwest Coast, exclusive access extended to foraging territories (hunting, salmon fishing and shellfish gathering grounds), and it was the exclusive rights to food-yielding areas that underpinned the right to distribute food competitively at feasts. Sedentism is feasible on the Northwest Coast, but generally not in Australia, although permanent villages were described at the time of colonization in South West Australia (Hallam 1989).

Woodburn classes Australian Aboriginal societies as having delayed return primarily because they practice strategic marriage alliances lining clans (1982: 449, n3). The cultures found in Australia north of the MacDonnell Ranges also embody clan totemism, which makes them appear similar to the undoubtedly delayed-return societies of the Northwest Coast of North America. Cross-cousin marriage will only generate regular alliances when it is practiced between unilineal descent groups. Further south, in the Western Desert, people have the option of joining the band in whose country they were born, or their father's or mother's band. This negates the value of cross-cousin marriage as a means to create inter-group alliances. Membership of a local group accrues through time, as one demonstrates a commitment to living and sharing with other members and caring for the local country (Layton 1995).

Even in Northern Australia, where unilineal clans exist and cross-cousin marriage is practiced, water is the only resource dense and predictable enough in location to be defended. Sacred sites, to which only members of the local group in whose country the site lies have access, are always situated near water. On the other hand, the local unpredictability of rainfall and consequent variable abundance of food resources make it beneficial to allow neighbouring groups (bands or clans) mutual access to the remainder of the local group's country. Social boundary defence is therefore practiced, although visitors need guidance from members of the local group to avoid unintentional trespass on sacred sites. Some Native Australian societies appear to have followed a trajectory towards the territorial aspects of 'delayed return' (Woodburn) or 'complexity' (Price and Brown), but only as far as ecology permits [and I don't mean to imply they were trying to get further but failed!]. The most common route toward differences in power is to acquire more religious knowledge over a wider region than other members of one's generation, which generates respect and even fear. In a few societies on the north coast of Australia, men can also negotiate marriages between clans in such a way as to gain more wives than their younger brothers (see Hart & Pilling 1960: 15–18 on the Tiwi, and Keen 1982 on the Yolngu). Today, and in the recent past, the Northwest Coast was substantially different. Totemic clans defended resource patches and killed trespassers found on their territories. Food was processed by smoking, drying or potting in fat, and stored for the winter season of feasting. During the summer, clans accumulated surpluses of food in their own territories which were then distributed during competitive inter-clan feasting in the potlatch.

Hayden (2018) argues that secret societies seem only to emerge among transegalitarian (complex) hunter/gatherers and subsequent agricultural tribal or chiefdom societies. Hayden concludes that secret societies probably do not exist in Native Australia and I agree. However, Hayden's criteria for the presence of secret societies among hunter-gatherers (this volume) provides a useful measure of the relatively egalitarian character of Native Australian societies, because it highlights which characteristics are not satisfied (Table 7.1, based on the characteristics set out in Hayden (forthcoming, chapter one). In compiling this table I have relied mainly on my field experience with the Anangu of the Western Desert and the Alawa of the 'Gulf Country' south of the Gulf of Carpentaria, with more limited knowledge of the Worora on the Kimberley coast and the Gunwinggu of Arnhem Land. Measuring Australian cultures against the characteristics that Brian Hayden identifies in secret societies shows that the features most likely to be associated with sedentism are absent.

Hayden (forthcoming: 267) suggests that the Djanggawul ceremony among the Yolngu of Arnhem Land comes closest to constituting an Australian secret society. Howard Morphy and his linguist wife Frances attended a Djungguwan (Djanggawul) ceremony during their long-term field research among the Yolngu. Howard Morphy writes that the Yolngu system of knowledge is a progressive one, linked to a hierarchy of status, but 'Individuals acquire the knowledge often in a relatively informal way – through participating in ceremonies, being taught by senior members of their clan, showing a willingness and capacity to learn, and being trusted' (Morphy 1991: 84). There were both restricted and public ceremonial grounds, but the restricted ground was simply a clearing where men prepared sacred objects, painted their bodies and performed secret phases of the ceremony. Women nonetheless know much of what happen on the men's ceremonial ground. It seemed to the Morphys that women were excluded from certain contexts and occasions rather

Table 7.1. *Are there secret societies in Aboriginal Australia?*

Characteristics that are present
Regional interaction spheres. Yes: major ceremonies provide the primary context for regional gatherings.
Ritual sites are characterized by distinctive configurations of rock art. Yes, sometimes, providing the site is located near suitable rock surfaces (see, for example the case of the art of the Wandjina in the Kimberley region).
Ritual paraphernalia is concealed or destroyed between performances. Yes.
An iconographic 'vocabulary' identifies which ancestral being (kangaroo, python, emu etc.) is represented in body decoration or cave painting, although the art style of the Kimberley and Arnhem Land is considerably more representational than the 'geometric' style of central Australia.
Several distinct ritual cults in the same community; age and sex divisions in cult membership. Yes, there are both men's and woman's cults, to which all or part of which the other gender is denied access.* However, in moiety cults such as those in the Gulf Country there is a division of ritual labour between the Miniringgi 'owners' who belong to clans in one moiety and the Junggaiyi 'workers' (sisters' sons of the Miniringgi) in the other moiety. At a ceremony the Minirringgi dance wearing sacred painting identifying them with their totemic ancestors while the Junggaiyi prepare the dance ground, paint up the Minirringgi and sing the ritual song cycle. These roles are reversed in the other moiety's ceremony, so inequality is avoided. The organization of major ceremonies is therefore such that they cannot be held without drawing on co-operation from a variety of groups or kin categories, rather than confined to a select few initiates. Indeed, the purpose of the ceremonies is to reinforce a regional network of inter-clan relationships.
Esoteric knowledge. Yes, this is the key resource held by senior men and women. Initiates are instructed in progressively deeper levels of understanding concerning the landscape created by the totemic ancestors and its social implications.
Characteristics that are partly satisfied
Special ritual sites in remote locations. Yes, with the caveat that 'remoteness' may be culturally defined as no-go areas relatively close to camp such as a rock shelter or a clearing naturally surrounded by boulders.
Ecstatic states. When dancers in a ceremony are painted to represent their totemic ancestor and dance to the accompaniment of verses from the song cycle tracing the ancestor's travel, they become, or embody that ancestor. No hallucinogens are used, but the dancer may achieve an altered state of consciousness.
Characteristics of secret societies that are not found
Amassing the high fees required for initiation and advancement are predicated on the ability to produce reliable surpluses and storage. No. Australian ceremonies can only be held during periods of natural resource abundance. They therefore take place more rarely in the Western Desert than in the Gulf Country. But even in the Gulf Country and Arnhem Land ceremonies are only held once every few years, perhaps because the low population density is insufficient to generate enough young people to initiate more frequently. On the Northwest Coast they are held every year during winter, accompanied by feasts.
Feasting. No. The logistics of ensuring all members of a large gathering have sufficient to eat is hard enough to achieve. One Gunwinggu man described to me how a large goanna (lizard) might be caught alive and tied to a tree with one leg amputated to prevent it escaping until it was needed as food. Usually women forage for vegetable foods to feed everyone, if (or when) they are not themselves participating in the ceremony.
Special structures used for rituals are erected within or near the community. Not found, even in permanent settlements established since colonization, although simple, temporary structures may be constructed on ritual grounds.
Human sacrifice and cannibalism. Not in Australia. Hayden (forthcoming, chapter two) states that on the Northwest Coast slaves were sacrificed during ceremonies but considers evidence for cannibalism to be questionable.
Special burials of high-ranking members. Not in Australia, and Hayden notes that it is difficult to prove on the Northwest Coast.

* Both in the Western Desert and in the Northern Territory's Gulf Country I was made aware of women's cults from which men are excluded.

than from acquiring knowledge (87). As in the Gulf Country, the senior sisters' sons, members of the other moiety, made decisions and were consulted before each phase of the ceremony. The senior sister's son oversaw the production of every painting and started most of them himself. He also marked out the ceremonial ground. As in the Gulf Country, the other moiety has a parallel ceremony, the Gunabibi (Berndt 1951; Warner 1958: chapter 9), in which these roles would be reversed.

The features not found in Australia, but present on the Northwest Coast of North America, are absent due to lower population densities, the difficulty of storing food, the lack of dense and predictably located resource patches that are defendable, and the need for geographical mobility beyond one's own local group and its 'country'. A mutually reinforcing relationship therefore appears to exist between sedentism, aggregation in villages, inequality and the defence of territories (the horizontal axis on the 4-cell diagram, Figure 7.1).

For Jérôme Rousseau (2006), social evolution means progressive evolution, from simple to complex societies, and not Darwinian adaptation to specific environments. He accepts Woodburn's claim that the distribution of immediate and delayed return systems cannot be explained by ecology, and argues that Middle-range societies emerge with the transformation from immediate to delayed return. This comes about because 'it is onerous to be obliged to share the product of one's labour with others' (61). He does not consider whether agents' behaviour is itself adaptive, for themselves or for those who exploit them. Ecology does not, *contra* Rousseau, just impose limits on agency; it also encourages particular types of social strategy. If sharing and reciprocity become 'onerous' rather than beneficial to the participants, it is because the ecology (fitness landscape) of social interaction has changed. The Prisoner's Dilemma was developed to model the circumstances in which the mutual trust on which reciprocal altruism depends can be sustained, and the circumstances in which it will break down.

The Prisoner's Dilemma and its endgame

Axelrod's classic work on the *Prisoner's Dilemma* shows the adaptive value of repeated exchanges in which participants can develop mutual trust so that each party will uphold a commitment to sharing and reciprocity. The Prisoner's Dilemma models a situation in which two prisoners (thieves, or freedom fighters) have been captured and placed in separate cells. Under interrogation, each is told that if both confess, they will receive a light sentence, in recognition of their collaboration with their jailers. If they remain silent when the other confesses, they will be severely punished. The prisoners realize that, if neither confesses, they will both go free. Axelrod (1990: 10–13) appreciated that co-operation (mutual silence) would only be achieved if each prisoner knows he can trust the other. Since they are isolated in different cells, trust must be based on prior knowledge. To rely on each other, the prisoners must have already interacted with each other in ways that test their mutual loyalty.

Axelrod also found that, for reciprocity to persist, participants must anticipate that the relationship will continue indefinitely into the future. If partners anticipate no longer needing each other they will defect. Jansen documented this outcome during the disintegration of Yugoslavia in the 1990s. Once it became clear that Yugoslavia would soon cease to exist, and people would need to identify as Serb, Croat or Bosnian if they were to keep their houses and jobs, they frequently broke off personal relationships with members of other ethnic groups. 'Suddenly everything had to change: address books, the language and our names, our identity…. Everything changed with astonishing speed into old garbage' (Jansen 1998: 95, quoting the novelist Dubravka Ugrešic). People who had not discarded their old identities became known as 'Yugozobies'.

In the open field zone of England, a stable social system existed for some 800 years after AD 1000, in which each village's land was divided into two types; ploughed fields and common grazing. The productive capacity of common land was too low and unpredictable to justify its division. Every household managed its own plough-land, but the commons were jointly managed and each household was entitled to put livestock on common land. Access was regulated by a village committee whose members determined how many animals each household could graze, to avoid overuse. The committee also made sure that no-one's ploughing encroached on public footpaths or neighbours' strips. This system broke down as farming techniques and the market for agricultural produce improved, tempting wealthier villagers to enclose portions of the commons for their own exclusive use and profit, renouncing their obligations toward poorer fellow-villagers. A wave of enclosure, at its peak between 1760 and 1820, spread across the open field zone and brought the system in England to an end (see Layton 2000, 333–48 for a detailed discussion of competing analyses of the dynamics of enclosure, and the different trajectories followed in England and France).

James Scott (1976, 207–12) described a similar process in Southeast Asia that followed the introduction of Green Revolution crops during the 1960s, whose consequences he compares to the Enclosure Movement in England. Only relatively wealthy villagers could afford the risks of adopting the new Green Revolution crops because, although they gave greater yields in the long run, they were more vulnerable to failure in the short term. This risk could only be tolerated by those living above subsistence level. The new crops also required chemical fertilizer and more sophisticated equipment or hired labour to cultivate and harvest. Networks of mutual aid broke down and poorer villagers were liable to become wage labourers working for their increasingly wealthy neighbours, or obliged to migrate to the cities (Scott 1976: 15–20).

Inequality before farming

The transition from equality to inequality documented by the ethnographic examples above would, from an archaeological perspective, have seemed instantaneous. How quickly might the social organization of a hunter-gatherer community shift from reciprocity to competition if circumstances were to change such that it was no longer in people's interests to maintain relationships of reciprocity and co-operation with neighbouring groups (bands, clans)? Ben Fitzhugh's paper (this conference) on the archaeology of Kodiak

Island and the Kuril chain, put beside the work of Maschner and others on the archaeology of the Northwest Coast of North America (Maschner 1997; Ames & Maschner 1999; Hoffman et al. 2016; Coupland et al. 2016), may throw light on this question (see Table 7.2).

Both columns in table two indicate a five thousand year period of occupation by small, mobile bands before evidence implying claims to exclusive, defended access of resources appears. This transition takes place around 4000 BP on the Northwest Coast. Hoffman et al. (2016) describe their investigation of an archaeological site located in what was once an ecologically rich wetland on the edge of a stable sandy ridge on the lower Fraser River. At around 40,000 BP a garden was created to cultivate *wapato* (*Sagittaria latifola*) the edible root of a water plantain that was an important source of dietary starch during the winter. The base of the garden was artificially lined with stones that may have previously been used in roasting pits. Gardening was most intense during the period 4100–3200 BP, after which the site was abandoned. Ancient *wapato* tubers were excavated, along with the broken ends of nearly 150 probable digging sticks used to prize the wapato roots free from the stone platform.

During the period that *wapato* was cultivated (the late Charles Culture, 4000–3500 BP), cemeteries also came into use in the coastal Salish district, implying, as Coupland et al. (2016) point out, a more stable residence pattern than previously practiced. Coupland et al. describe large quantities of stone and shell beads associated selectively with cemetery burials. Most graves at *Tsawwassen* contained few or no beads, but one young individual aged 11–14 was associated with over 53,000 stone beads. In view of his young age, Coupland and his co-authors plausibly conclude that the beads imply differential inherited status. At *Green Point*, another late Charles Culture burial site, the remains of at least 4 individuals were excavated, but only one was associated with (stone) beads, of which there were 'thousands'. The third site, *DjRw-14*, which is the main subject of Coupland et al.'s paper, contained five burials. Burial 2, the earliest (6490–6350 BP), was rich in both stone and shell beads. The other four burials all date to the late Charles Culture. Burial 1 contained 350,000 stone beads and 1,000 shell beads. Burial 3 contained the skeletons of two young men but yielded only 650 stone beads and 1,550 shell beads. Burial 4, of an infant, contained no beads at all. Just as the *wapato* garden was abandoned at *c*. 3200 BP, the use of cemeteries was a localized development and only lasted for around 500 years. Coupland et al. point out that the emergence of social inequality in the Salish Sea region was not, therefore, a steady, irreversible evolutionary progression.

On Kodiak Island the transition to defended territories takes place around 2500 BP. The subsequent record could be interpreted as a kind of domino effect, in which a succession of changes leads to ever greater inter-group rivalry (cf. Renfrew 1978). Eventually, villages were compelled to participate in trade and warfare in order to resist a network of neighbouring competitors (Fitzhugh 2003: 34).

In Australia it is the relatively unpredictable ecology and the lack of regular (seasonal) surpluses that renders sharing and reciprocity more adaptive than hoarding and competition. This poses the question, can the archaeological transitions from mobility to sedentism and from peaceful interaction to warfare documented on the Northwest Coast and Kodiak be explained by the gradual emergence of seasonally predictable abundances in food sources?

At a gross level, climatic conditions have been stable since the time the Northwest Coast was settled (White et al. 2015). Between 20,000 and 15,000 BP the climate had been highly variable, cold stadials alternating with warm interstadials. During this period, a founding human population entered Beringia. From 12,900 to 11,600 BP the younger Dryas, the last major stadial, took place. However, at about 11,600 BP, the period when the northwest coast was occupied, the Younger Dryas came to an abrupt end, giving way to several millennia of optimal conditions which corresponded to the Early and Middle 'Archaic' (White et al. 2015: 118) in Native American archaeology. Between 8000 and 4000 BP the Mid-Holocene Transition brought a drier climate. The only dramatic climatic event thereafter was the 'Little Ice Age', beginning at 700 BP. White et al. (citing Anderson 1995; Benson et al. 2009) note this period was associated with increasing warfare, migration and malnutrition in North America, yet defensive sites were already being constructed on both Kodiak and the Northwest Coast.

At a local level, two ecological changes on the Northwest Coast seem potentially significant. The first was the stabilization of sea-levels at their present position by 5000 BP (Ames & Maschner 1999: 88). This also stabilized the lower courses of rivers draining into the ocean, 'encouraging the growth of ecologically productive estuarine and deltaic environments including larger salmon runs.' Second, Red Cedar used to construct clan houses and ocean-going canoes did not reach its present distribution until between 5000 and 3000 BP (Ames & Mashner 1999: 52). Even then, they comment, it would have taken another several hundred years before cedar trees were big enough to make large canoes or house planks. Evidence of plank houses and villages appears during the Middle Pacific period and the rectangular plank house characteristic of permanent villages seems to be an early Middle Pacific

Table 7.2. *Chronology of the transition to inequality on the Northwest Coast and Kodiak Island.*

Dates BP	Northwest Coast (Ames & Maschner 1999; Maschner 1997*; Coupland et al. 2016, Hoffman et al. 2016)	Kodiak Islands (Fitzhugh 2003 and this volume)
250	*European colonization*	*Russian conquest.* By contact period individuals claimed ownership to most resource patches. Inherited rank, competitive feasting and supra-village alliances.
500	Most defensive sites built between 1200–700 BP, when population peaks. Villages moved to sites on long, straight shorelines, giving better visibility, but at cost of vulnerability to storms and less easy access to inter-tidal or open water resources. Consequent sharp rise in relative importance of salmon in diet	Multi-roomed houses in large defended winter villages. Non-local warfare in which villages sacked, men killed and women enslaved. Whale hunting. Trade networks. 750 BP: *Late Kachemak ends, Koniag Period begins.*
1000	Warfare evidenced in construction of defensive sites in defensible locations, and in population decline (267). Houses are much larger and located in larger villages, some on headlands and rocky bluffs	Small defensive sites evidence for localized warfare
1500	Bow and arrow introduced to region between 1800 and 1500 BP	
2000	*'Middle Pacific' period ends* (1800–1500 BP); *'Late Pacific' period starts*	
2500	Cemeteries imply sedentism and group territories. Sea level reaches present position, larger salmon runs.	2200: *Late Kachemak.* Population growth, local competition, mortuary tradition and enhanced identity marking through art implies signalling group membership, status displays.
3000	Red cedar reaches its present distribution between 5,000 and 3,000 BP	
3500	*'Middle Pacific' period starts:* Large shell middens associated with house floors. Many artefacts and 'behaviours' start to resemble ethnographically known Northwest Coast culture, but settlements are much smaller and less permanent than in Late Pacific with smaller houses. Weapons found in archaeological sites. Majority of victims are men	3700: *Early Kachemak*: notched pebbles interpreted as net weights; semi-circular knife blades increase efficiency of food processing. Aggregation in mainly winter villages, located at stream mouths and along larger rivers.
4000	4200: earliest shell middens; may have accumulated at defensive sites. Garden plots and cemeteries in Coast Salish area (Coupland, Hoffman)	4000: Tents replaced by semi-subterranean dwellings. Evidence of growth population and sedentism 4500: Intensive salmon processing begins [conference paper]
5000	*Early Pacific Period:* First evidence of conflict seen in non-lethal skeletal injuries	*Ocean Bay 2:* 5200–3700: flaked stone tools replaced by ground slate hunting and cutting implements
5500	*'Early Period' ends*	
6000		
7,000		*Ocean Bay Period:* Generalized technology exploiting coastal resources. Small residential groups regularly moving camp
7500		Kodiak Island first occupied
8000		
9000		
10,000		
11,000	*'Early Period'* Northwest Coast first occupied, groups are small and mobile. No archaeological evidence for warfare or conflict	

* Maschner's dates, expressed as BC/AD, are here converted to BP (zero BP = AD 1950, but since the table deals in units of 500 years, I have rounded this up to AD 2000)

innovation (Ames & Maschner 1999: 93, 141). Ames & Maschner (1999: 48) sensibly caution that 'Given the long temporal scales at which archaeologists work, it is frequently possible to see changes in human economy and society that occur at more or less the same time as climatic and other environmental shifts…. Our view is that climate or the environment do not cause anything. Rather, they set the parameters and rules under which people make decisions.'

Fitzhugh (2003: 13, my emphasis) gives more weight to technology 'The emergence of complexity requires a variable landscape with productive, stable and defendable resource patches punctuated by less productive and stable zones. *The Kodiak case illustrates the importance of technology and demographic characteristics in the creation of such an environment.* Ultimately, it is political competition (physical and symbolic) and not a direct form of population pressure that facilitates the establishment of ranked and stratified societies.'

Maschner argues that population density on the Northwest Coast never reached its potential carrying capacity, and therefore it was not shortage of land that caused warfare. Wars on the Northwest Coast were fought over status, prestige, revenge, women, raw materials 'and occasionally, food and territory' (Maschner 1997: 270). During the historic era, there was intense conflict over control of trade routes. On the other hand, Maschner also notes that revenge wars often ended with enslavement of losers (pp. 288–91), and 'it was rather common for one Nootka group to attack and annihilate a neighbouring Nootka group in order to take their lands and primary fishing locales' (p. 291, citing Drucker 1951).

Conclusion

As Coupland et al. point out, the chronological sequences identified on the Northwest Coast and Kodiak Island are not evidence for 'a regular evolutionary process' in the sense of a universal trend. They are parallel responses to specific climatic changes that occurred in the Northern Hemisphere after the last glaciation. There had probably been no comparable ecological shift since before modern humans moved into Europe as the last interglacial was coming to a close. Moreover, Fitzhugh importantly concludes that while social inequality and inter-group competition was developing on Kodiak Island, communities on the central Kuril Islands continued to sustain interdependence and local egalitarianism, because resource patches were generally not worth defending and resource yields were unpredictable.

Kodiak Island and the Northwest Coast both show social trajectories toward increasing social inequality enabled by a changing ecological envelope but generated by [Marxist] dynamics of ownership and exchange of property in which individual agents were caught up in social relationships upon which they depended, although the wider consequences of which were beyond their control. The seasonal richness of the northwest coast environment, and the facility with which food could be stored in this cool temperate environment, were beyond any possibility in central and northern Australia. The extent to which society and technology took up existing possibilities in their ecological envelope in the last four to five thousand years, or the extent to which the ecology was itself changing, remains a question for further investigation.

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Part II
Social inequality in Upper Palaeolithic Europe

Chapter 8

Did secret societies create inequalities in the Upper Palaeolithic?

Brian D. Hayden

If we, as prehistorians, would like to know what social life was like in the Palaeolithic, including aspects of inequality, we cannot avoid basing key aspects of our models on ethnohistoric or ethnographic accounts of hunter/gatherers at one level or another, for better or worse. The *Man the Hunter* conference and volume made a major contribution towards clarifying the range of variation and the basic similarities of foraging (or simple hunting and gathering) societies in terms of subsistence, mobility, social organization, sharing and egalitarian values, and other fundamental characteristics (Lee & Devore 1968). These conclusions were largely based on ethnographies of the San, Hadza, Boreal Cree, and Australian Aborigines. While brief consideration was also given to more complex types of hunter/gatherers with quite different characteristics, these were not a major focus of attention and subsequently have been largely ignored by most prehistorians and others dealing with the Palaeolithic. Indeed, when most archaeologists speak of Palaeolithic hunter/gatherers informally or in publications, it is almost always stated or implied that they refer to foragers (simple hunter/gatherers) rather than seasonally sedentary complex hunter/gatherers (see Arnold et al. 2016; Hayden 2014; Guy 2017: 19–21). As a case in point, Testart (1982 – see Guy 2017: 59, 102, 254–7) insisted that Upper Palaeolithic groups in Western Europe were all egalitarian foragers. Nevertheless, as this conference indicates, over the last few decades, there has been an increasing awareness that many aspects of Upper Palaeolithic archaeology do not conform to the ethnographic accounts of simple foragers (Hayden 2007, 2008; Guy 2017). Rather, the high population densities, seasonally or fully sedentary habitations, the indications of mass harvesting and storage, the specialized art and prestige items, the rich burials including those of children, and indications of feasting – among other things – have engendered a very different view of Upper Palaeolithic economic and social life which is more consistent with accounts of complex hunter/gatherers such as those in California and the Northwest Plateaux of North America.

The differences between simple foragers and complex hunter/gatherers can be briefly summarized as follows. Simple foragers typically could only extract limited amounts of food from their environments. Consequently, their population densities were low (usually less than 0.1 per sq. km), they had to move about the landscape at regular intervals to access different food sources, long-term storage was absent, there was no labour-intensive architecture, sharing and egalitarian ethics dominated values and behaviour, emphasis was on group well-being, individual aggrandizement was not tolerated, competition involving food resources was proscribed, prestige objects were absent or rare or relegated to communally held ritual domains, and private ownership of resources was extremely limited or absent. In short, they epitomized hunter/gatherers as *Man the Hunter* volume typified them.

In contrast, complex, or transegalitarian, hunter/gatherers had the resources and technologies to extract significantly more resources from their environments to the point of producing some surpluses for exchange or other uses in normal years. As a result, their population densities were higher, (usually above 0.2 people per sq. km – Ames 2004: 367), they were seasonally if not fully sedentary, they typically stored considerable volumes of staple foods, obligatory sharing of food was reduced to immediate kin, prestige or wealth items occurred regularly in domestic and funerary contexts, and prestige items as well as storage facilities and resource locations were individually or family owned. There was surplus-based feasting and competition over a range of socio-political and economic privileges, and marriage involved wealth exchanges. These factors resulted in significant socioeconomic inequalities sometimes even involving slavery, e.g., among Northwest Coast groups, the Ainu, and the Calusa.

Together with others like Arnold et al. (2016), I have argued that the emergence of complex hunter/gathers, rather than the advent of agriculture, was the most important cultural watershed in cultural evolution (Hayden 2014). Complex hunter/gatherers established the socioeconomic premises upon which all subsequent cultural developments were created, including the Industrial-cybernetic societies of today. All of the major technological advances usually attributed to the agricultural revolution actually occurred first among complex or transegalitarian societies, including: pottery, use of metals, monumental architecture, fine art, specialist crafts, brewing, music, and cultivation. Social and ideological changes usually attributed to the Neolithic also first appeared in complex hunter/gatherer societies, including ancestor worship, hereditary classes, indebtedness, and slavery.

Thus, there are two diametrically opposed interpretations of Upper Palaeolithic society: egalitarian foragers vs. complex hunter/gatherers. Together with researchers like Bordes & Sonneville-Bordes (1970: 64), Jochim (1987), Soffer (1989), Beaune (1995), Alhouse-Green (2002: 226, 230), Vanhaeren & Errico (2005), and Guy (2017), I have argued for some time that there is compelling archaeological evidence that at least in the most favourable Upper Palaeolithic environments such as the Southwestern French refugia, societies were transegalitarian in nature (Hayden 1990, 2001, 2007, 2014; Owens & Hayden 1997). The mere presence of recurring prestige items constitutes an important indicator of transegalitarian organization. I have suggested that the breeding of dogs also occurred for prestige purposes (in part due to the costs involved – see Hayden 2014: 120). The documentation of these practices in the Upper Palaeolithic by Germonpré et al. (this volume) further supports such a view.

If we examine ethnographic uses of prestige items, they were used for a limited range of functions in traditional societies, all of which were fundamental to transegalitarian dynamics (Hayden 1998, 2008: 87). These functions consisted of:

1. converting surplus production into more durable and fungible material forms;
2. displaying economic success;
3. contracting important sociopolitical relations or hosting important sociopolitical events, including marriages, alliances, feasts, funerals;
4. substituting surplus production or wealth for human lives (in compensation payments for deaths or injury, or as compensation for the loss of a kinship member through marriage);
5. creating debts.

I maintain that the proliferation of portable art and prestige items (e.g., beads, shells, sculptures, amber, Solutrean laurel leaves) in the Upper Palaeolithic in some regions reflects the use of prestige items for some or all of the above socioeconomic functions.

I have also suggested that with the production of surpluses – in part a natural outcome of storage according to Testart (1982) and Halstead (1989, 1990) – ambitious individuals began to devise a number of strategies to use surpluses in order to advance their own self-interests in terms of power and wealth. These strategies included: feasting; contractual debts; establishing wealth as a prerequisite for marriage or proper funeral rites; the need for wealth to create defensive alliances; wealth penalties for breach of contract or injuries or for infractions of community taboos; the use of wealth or feasts to obtain positions of political power; and the use of wealth to access powerful supernatural forces. I have discussed a number of these strategies elsewhere. Here, I would like to explore the role of wealth-based rituals in creating inequalities in the Upper Palaeolithic. I have suggested that such rituals most prominently took the form of ancestor cults and secret societies (Hayden 2003, 2008: 100, 102). Both ancestor cults and secret societies were relatively common features in ethnographic transegalitarian hunter/gatherer societies, and both could occur in the same societies. For example, some Californian groups had both *Kuksu* secret societies and ancestral mourning rituals; and on the American Northwest Coast and Interior, secondary burials (indicative of ancestors' importance) and ancestral totem poles occurred in communities together with a variety of secret societies. Since these cult types were fairly common among ethnographic complex hunter/gatherers, shouldn't we expect them to have been common among prehistoric complex hunter/gatherers as well?

Ancestor cults

In an article with the fetching title, '"Magdalithique" et "Mégaléniens"', Van Berg & Cauwe (1996; Cauwe 2001) documented Upper Palaeolithic human remains that resembled burial or disposal patterns in the Neolithic, especially in megalithic areas. Human remains from both periods were characterized by a few special burials with most remains from other individuals being fragmented, manipulated, dispersed, and moved around the landscape. In the Neolithic, this might be most parsimoniously interpreted in terms of removal of body parts for ancestral veneration. This similarity of patterning raises the question of whether ancestor cults existed in the Upper Palaeolithic. Similarly, the occurrence of secondary burials in the Upper Palaeolithic (Beaune 1995: 252; Pettitt 2010) is most plausibly a part of ancestor veneration (Hayden 2003, 2008: 100). As Teit (1900: 330) noted for one group of Northwest Interior Indians, there was no burial for the poor, and only the most wealthy had secondary burials. Although no attempt has yet been made using Lorenz curves to quantify the degree of inequality represented by Upper Palaeolithic burials, the great disparities in grave goods would almost certainly yield very high Gini coefficients of inequality characteristic of some of the most stratified societies known (see Schulting 1995; Kohler & Smith 2018).

Ethnographically, ancestor cults were used to claim rights to resources and as warrants for lineage heads to impose their wills on younger lineage members and affines, as well as to leverage resources from other lineage members for rituals and feasts that were promoted as necessary for good crops, fertility, and economic success – all putatively bestowed by properly venerated ancestors as exemplified in the Torajan area of Sulawesi (Eliade 1958: 350; Freedman 1965, 1970; Lewis 1989: 102–32; Sandarupa 1996). Typically, in order to render an ancestor powerful in the afterlife – i.e., able to provide material benefits for descendants – costly sacrifices of animals, displays of prestige items, and consumption of prestige foods were required. Many of these things were bestowed upon guests, thus creating alliances and debts that could be used to structure political power and further the host's economic advantages via marriages with desirable families, access to resources and labour of other kin groups, and support in any conflicts whether within the village or intervillage (Hayden 2009).

Thus, to promote their own power-base and economic control, ambitious individuals pushed funerals to become as expensive as a kin group could bear. Subsequent expensive rituals for ancestors were used for the same ends as well as to justify material and social inequalities – i.e., the ownership of resources and the production of surpluses were not due to the exploitation of others, but were due to the carrying out of rituals that empowered some ancestors to bestow material success upon those performing the rituals. If families were poor, it was blamed on the fact that they did not perform the proper (costly) rituals (which only the rich could afford – see Hayden 2009 and 2017 for examples from Southeast Asia). It seems evident that ancestor cults were used to create power within kin groups, to create debts within and between kin groups that advanced individual self-interests, and to create justifications for the resulting inequalities. I use this example simply to make the general point that rituals – at least those that require wealth – can be used in the creation of socioeconomic inequalities, and that this was a plausible tactic used by ambitious individuals in some of the better-off Upper Palaeolithic groups in Western and Eastern Europe.

Secret societies

While the study of ancestor cults is relatively well studied ethnographically and almost self-evident in many archaeological contexts – from Neolithic chambered tombs to Egyptian pyramids – another similar strategy for using rituals to create socioeconomic inequalities has received remarkably little attention by most archaeologists. I refer to the role of secret societies as possibly present and powerful in many surplus-producing communities from the Classical Age back to the Upper Palaeolithic. The topic may be unfamiliar to many prehistorians, especially in Europe and the Near East. I will therefore first define secret societies and then discuss some of their important characteristics for archaeologists. We can then examine the material record of the Upper Palaeolithic to see what the potential applicability might be for using the secret society concept for interpreting the social and ritual structure of the time.

Definitions: What are secret societies?

Historically, secret societies among tribal, transegalitarian, and chiefdom societies were voluntary, ranked, ritual associations whose memberships, or at least the upper ranks of memberships, were exclusive and who typically claimed to possess ritual knowledge of great value to their own members or knowledge which could be used for the benefit of others, usually at a cost. This ritual knowledge constituted the 'secret' in these organizations. The existence of the societies and their memberships was typically public knowledge and was not part of the 'secret'. In fact, secret societies generally put on periodic public performances and feasts to demonstrate their arcane powers and their profane wealth. As documented in detail in my monograph on secret societies (Hayden 2018), in order to obtain access to the ritual knowledge held by high ranking members, initiates characteristically paid high admission and advancement fees involving wealth payments and feasts given to the society. Because of this, secret societies were only found in areas where significant amounts of surpluses occurred. Although secret societies generally claimed to undertake rituals for the benefit of their communities – or alternatively terrorized their communities with displays of putative untamed spirit powers – the underlying motives of secret society leaders was to increase their own benefits, wealth, and power (see particularly Hoffman 1891; Wissler 1916; Drucker 1941; Harley 1941a,b; Speiser 1996). Kinship organizations, like ancestor worship in lineages and clans, limited the extent to which ambitious leaders could extend their power. To overcome these kinship constraints, secret societies provided an effective way of extending control by recruiting wealthy leaders from multiple kinship groups. They even overcame community limitations by including members from a number of local communities thereby establishing regional ritual networks focused on the wealth and power aspects of members.

The power in the high ranks resulted from several sources. First, high ranking members were already the most wealthy and powerful members of the community with considerable kin or other support. With their memberships in secret societies, all the most powerful individuals combined their powers and resources. Second, the ideology of the secret society claimed that the community owed large debts to the secret society for its supernatural protection and for ensuring health and prosperity in the community. Third, various means were used to obtain acquiescence for secret society ideological claims and practices. These included: demonstrations of putative supernatural powers (essentially stage magic) or orchestrations of supernatural spirit appearances (in masks and costumes), the giving of feasts for the community with the expectation of acceptance of the society's ideological claims, and lastly, the use of force. Dominant secret societies claimed the right to punish, fine, or kill anyone who contravened their dictates and claims, justifying these actions on the grounds that transgressions threatened the well-being of the community (Drucker 1941; Deacon & Wedgewood 1934; Harley 1941a,b).

Material characteristics

It should be noted that there was considerable cross-cultural variability in many features of secret societies. Nevertheless, there were also some striking tendencies, especially in the most developed and powerful secret societies. Many of these characteristics can assist in the archaeological identification of secret societies (for details, see Hayden 2018). First, ethnographic examples typically developed a body of esoteric knowledge known only to the higher ranks. This esoteric knowledge often included astronomically knowledge that could be materially represented as in solar alignments.

Second, many secret societies also used costumes and masks to impersonate spirits or claimed the ability of members to transform themselves into animal forms (Fig. 8.1).

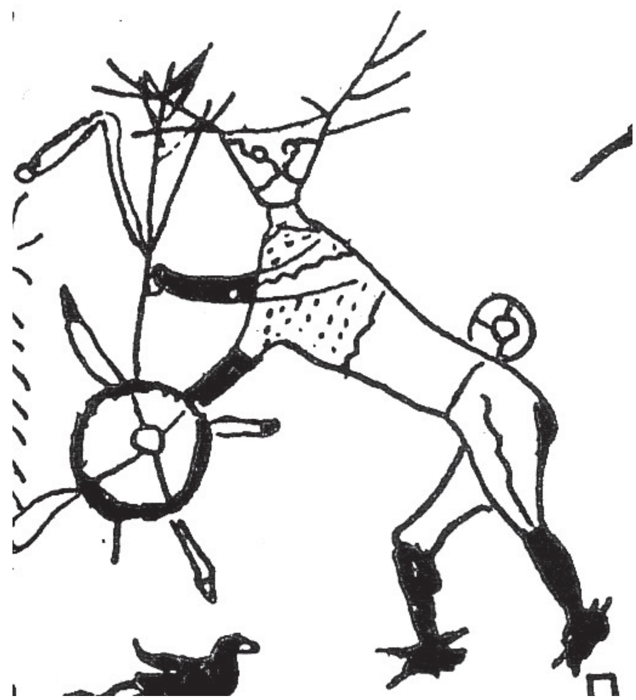

Figure 8.1. *A sketch of an Elk secret society dancer among the Ogalala Sioux on the American Plains (Wissler 1916: 87). This illustrates the use of masks and the transformation of ritualists into therianthropic animals. It also illustrates the existence of mythological composite beings.*

Third, aerophone instruments, especially flutes and bullroarers, were often used to portend the arrival of spirits or were said to be spirit voices, and were carefully hidden from non-initiates (Fig. 8.2).

Fourth, animal iconographies in secret societies generally did not focus on subsistence animals but rather animals viewed as powerful (e.g., bears, felids, snakes, scorpions, large herbivores), and sometimes included mythical beasts (Fig. 8.1).

Fifth, initiations usually involved the seclusion of the initiates and the induction of Sacred Ecstatic Experiences (SEE's) to convincingly demonstrate the power of the societies to contact sacred forces. Vision quests could be part of these seclusion rituals.

Sixth, human sacrifices and cannibalism featured in a number of secret societies, probably as techniques to demonstrate power, to ensure commitments of new initiates, and/or as emotional shocks that promoted altered states of consciousness.

A seventh common characteristic was that materials procured from distant sources, especially shells, and prestige items were typically used as society paraphernalia and imbued with special supernatural

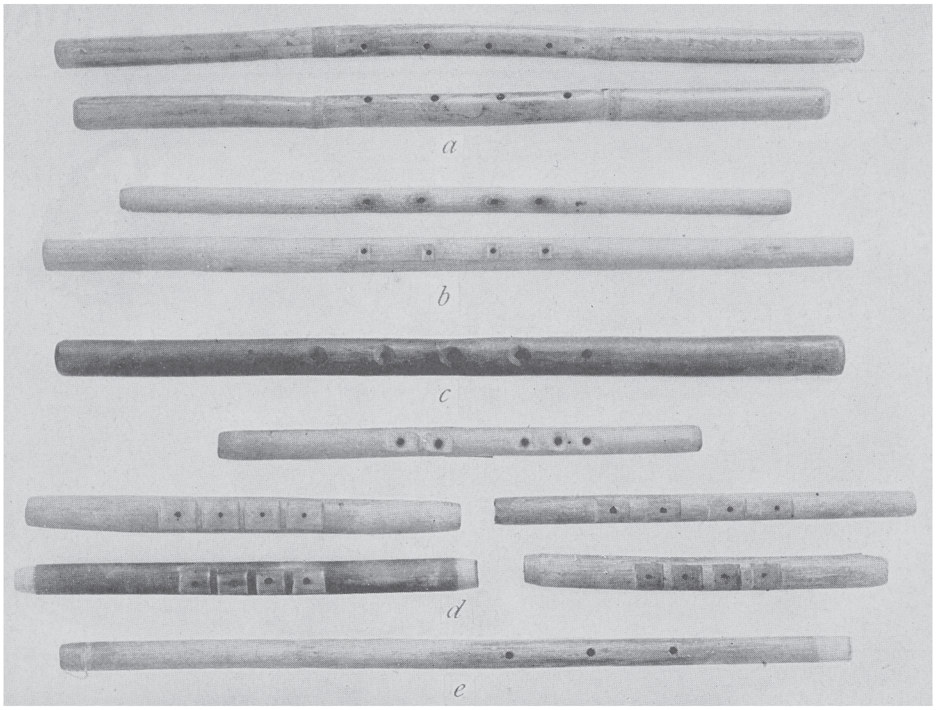

Figure 8.2. *Bone flutes used to represent the voices of spirits in Californian secret society rituals (Kroeber 1925: Plate 43).*

powers. Trade in these items as well as the spread of such cults to neighbouring communities helped to create regional ritual and interaction networks.

Eighth, decoration on objects generally reflected secret society iconography.

Ninth, special locations or structures in or near communities as well as remote locations were used for private secret society rituals or meetings. Of note, caves or rock shelters were sometimes used for remote rituals including solstice observances, fertility rites, initiations, seclusion, storage of ritual paraphernalia, and other unspecified rituals. For further details, see *Evidence from the Upper Palaeolithic* (below) and especially Hayden (2018). However, special structures, sometimes painted with power animals, were also located within communities and used for secret society meetings (Figs. 8.3 & 8.4).

Tenth, the most powerful leaders of secret societies were frequently buried in remote or special places to prevent their bones from being used to obtain supernatural powers, however, sometimes their bones, and especially their skulls were retained by the society for display and rituals. Such burials and skull retention only involved a few exclusive individuals and sometimes took the form of skull cults. For further details, see *Evidence from the Upper Palaeolithic* (below) and especially Hayden (2018).

Eleventh, many secret societies were dominated by men, but women not infrequently either had their own secret societies or participated in men's organizations in various roles.

Twelfth, young children of high ranking members were very frequently inducted into secret societies.

Evidence from the Upper Palaeolithic

Let us now compare the above characteristics to the archaeological record of the European Upper Palaeolithic.

Resources, surpluses, and complex hunter/gatherers

While many European regions undoubtedly had very limited resources, some areas became rich refugia for animals and corridors for animal migrations, especially in the foothill regions of the Massif Central (Jochim 1987). The sharp increase in the number of sites and the intensity of their occupation that occurred in the Upper Palaeolithic indicates new ways of extracting and storing foods. Mellars (2009: 216–17) even envisaged population densities in some areas rivalling population densities of agriculturalists (see also Guy 2017: 66, 267). Seasonal or full sedentism in some areas also attests to dramatically increased ability to extract resources as does the evidence for mass harvests,

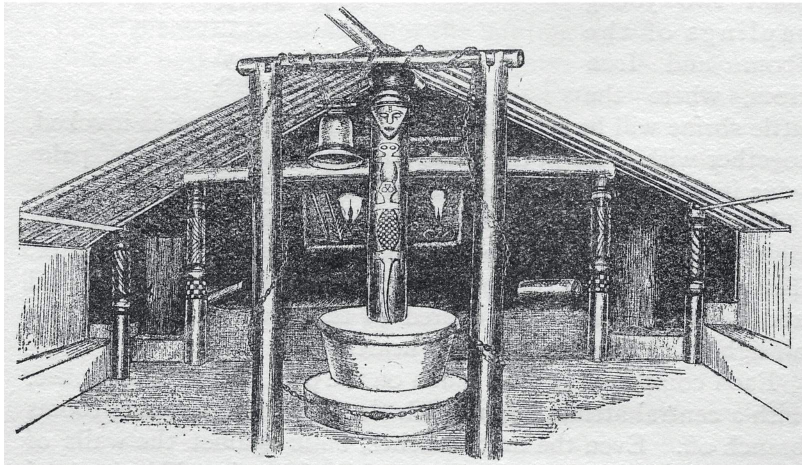

Figure 8.3. *The interior of an Egbo ritual house of the Ekoi tribe in Nigeria (Talbot 1912: 264). Note the drum at the back and the apparent cattle skulls (prestige or power animals) on the back wall.*

Figure 8.4. *The interior of an Egbo ritual house at Akangba, Nigeria (Talbot 1912: 249). Note the power animals painted on the walls.*

filleting and storing dried meat or fish, and locations of major sites near river fordings for capturing animals or fish (White 1985; Beaune 1995: 53, 81, 84, 132, 204, 216; Hayden 2007: 89; 2008: 97; Guy 2017: 80–2, 87–90, 198–9, 201–2). Moreover, the proliferation of exotic and prestige objects, some of which were brought 600 km from their sources (Gladkih et al. 1984, Taborin 1993), indicates that surpluses underwrote the exchange of non-essential luxuries. The breeding of dogs which had to be fed substantial amounts of food also indicates the existence of surpluses (see Germonpré et al., this volume). These features of Upper Palaeolithic societies also strongly imply that communities in favourable environments were complex hunter/gatherers.

The existence of a limited number of lavish Upper Palaeolithic burials, including children (e.g., Sunghir, La Madeleine, Grotte des Enfants, Arene Candide – Binant 1991; Pettitt 2010), further indicates the existence of surpluses or wealth and pronounced socioeconomic inequalities that are characteristic of complex hunter/gatherers. The fact that burials (especially those with substantial grave goods), cave art, portable prestige objects, and high site densities all tend to occur in the same restricted areas of Europe (such as the French Perigord and Charente) is a strong indication that there was something special about these locations favouring all these developments. The most obvious factor uniting them all was the high resource productivity of these areas. Why else would they be geographically restricted? In addition to the inferences derived from these factors, Emmanuel Guy (2017: 187–92, 209–13) has argued that the degree of realism displayed in Upper Palaeolithic art only occurs in societies with pronounced socioeconomic inequalities and wealthy patrons that could support the training of specialists to produce such art.

High costs of rituals and art

Because secret societies try to impress people with both their arcane and profane powers, and because they obtain considerable wealth from initiations or community contributions, secret societies have a strong tendency to develop the display art and underwrite its production. This can result in distinctive elaborately decorated sanctuaries (Figs. 8.3 & 8.4) as in West Africa, Vanuatu, and the American Pueblos which often featured iconographies of power animals (Hayden 2018). In fact, Speiser (1996: 373) observed that art in Vanuatu really only was common in areas where secret societies existed. The specialist training that must have been required for producing the masterpieces of European cave art, as well as the lengthy time and considerable effort (including scaffolding) that it took to complete major friezes of cave art (e.g., the procession of bison in Font-de-Gaume, the Axial gallery in Lascaux, or the life-size three-dimensional stone sculptures at Cap Blanc) all would have required considerable wealth to underwrite (Hayden 2008: 104). Some of these have been estimated to take weeks or months to create (Guy 2017). Similar heavy investments in secret society ritual features may be represented by the 'monumental' mammoth bone architecture on the Russian Plain at Mezin which could only accommodate a few people but would have taken about 60 man-days to construct (Gladkih et al. 1984; see Hayden 2008: 93). Secret societies would have provided not only a plausible motivation for creating this art and architecture, but also the material wherewithal to undertake such projects. In essence, I have argued that both cave art and portable art constituted prestige objects or displays (Hayden 2008: 90–1).

Small exclusive groups

Caves are ideal natural features for excluding unwanted observers and conducting affairs in private. Moreover, the spaces available for viewing some of the best paintings in Upper Palaeolithic caves were often small (Owens & Hayden 1997: 122, 153–4; Clottes & Lewis-Williams 1998: 20; Villeneuve 2008; Hayden 2018), implying that only small exclusive groups were involved (Beaune 1995: 238, 274). This is what one would expect of secret society memberships or at least their high-ranking leaders. Importantly, there is considerable ethnographic documentation for the use of caves by secret societies either for holding rituals or as locations for secluding new initiates (Hayden 2016, 2018). Good examples come from California where solstice rituals were observed and from the Northwest Coast where seclusions and initiations took place. In the American Pueblos secret societies also used caves for some of their special rituals involving fertility and success in war as well as for storing ritual paraphernalia. Archaeologists have often recovered important caches of ritual paraphernalia from such caves including feathers, scalps, prayer sticks, and weapons (Ellis & Hammack 1968). Additional examples of caves used for fertility or unspecified secret society rituals come from New Guinea and Vanuatu (see Hayden 2018). Given the suitability of caves for inducing numinous emotions, caves are eminently adapted for secret society activities.

Sacred ecstatic experiences

Caves are also ideal places for inducing altered states of consciousness and SEE's (Sacred Ecstatic Experiences). The other-worldliness of flowstone formations and the sensory deprivation of darkness and silence together with deep reverberations of sounds favour numinous experiences among those who enter these realms (Tuzin 1984). Some smaller caves with especially difficult access like Pergouset and Combarelles II could have been used for the seclusion of initiates which probably included vision quests. Ethnographically, vision quests were often associated with children in high ranking families (Schulting 1995).

Instruments

Almost all of the musical instruments recovered from Upper Palaeolithic sites are the same ones used ethnographically by secret societies to represent the voices of spirits. These are mainly flutes and bullroarers, but could easily extend to lithophones and drums (Morley 2009, 2013). Ethnographically, in order not to reveal the true nature of these sounds, the instruments were carefully kept out of sight of the uninitiated public. It is therefore of considerable interest that bone 'flutes are commonly found inside the decorated caves' (Morley 2013: 126) and in burials but rarely elsewhere (Morley 2009: 168–87, 106, 126; 2013: 41). Morley explicitly relates their use to ritual contexts (2009: 162, 167, 172 – see also Beaune 1995: 221).

Iconography of power animals

As many prehistorians have noted, Upper Palaeolithic cave and portable art focused on power animals rather than subsistence animals (Mithen 1988; Beaune 1995: 194, 198–9, 209–10). Why this was so has always been something of a conundrum, however such a feature is entirely expectable in the framework of secret societies. Thus, bison, aurochs, horses, mammoths, felines, bears, rhinoceroses were main features and could vary in frequency between caves or from one part of a cave to another (Guy 2017: 170–84) as often occurred with different secret societies or different grades within secret societies. The occurrence of some imaginary animals and 'ghosts' also has parallels in ethnographic secret societies.

Costumes and therianthropes

In addition to the dramatic lion-headed ivory sculpture with shoulder scars from Hohlenstein (Marshack 1991: Fig. 231), there are a number of cave images clearly depicting either masked individuals or therianthropic transformations into power animals (Beaune 1995: 169; 1998: 204; Otte 2016). One of the clearest examples is 'The Sorcerer' in Les Trois-Frères Cave (Fig. 8.5) which bears a remarkable resemblance to a secret society depiction from the American Plains (compare Fig. 8.1). While shamans used similar concepts, these rarely took the form of masks or were rarely materialized in sculptures. Such practices seem more consistent with secret societies including the use of body scars to identify *bone fide* members of secret societies at the regional level (Hayden 2018). Other archaeological materials that were probably used as costume elements include feathers, hides (with phalanges attached), talons, and shells. Upper Palaeolithic use and caching of these costume elements (usually in rockshelters or caves) has been recorded by Bouchud (1953) and others (Solecki & McGovern 1980; Laroulandie 2003 – see also Beaune 1995: 92, 168–9; Hayden 2008: 90–1).

Paraphernalia and exotica

Over the geographic expanse where secret societies occur, there is a great range of exotic items that could be used in secret society rituals including the feathers and talons mentioned above commonly used as *sacrae*. In the Upper Palaeolithic, shells were some of the most widely exchanged items (Taborin 1993), but jet and amber, stone beads or sculptures, and pelts with attached claws (Beaune 1995: 66, 175–9, 185) constitute other possible ritual materials. While these could simply be used as prestige items on clothing,

Figure 8.5. *The 'Sorcerer' from Les Trois Frères Cave in France (Bégouën 1909: 305). Compare this to Fig. 1.1. While the similarities may be convergences stemming from a common general belief framework, the similarities nevertheless strengthen the impression that the elaborate Upper Palaeolithic cave paintings (including mythic animals and transformed or costumed men) were products of secret societies.*

they could also be used in secret society rituals like the cowrie shells or quartz crystals obtained from great distances comparable to Upper Palaeolithic transport of shells over 600 km from sources (Taborin 1993). The shells used by the Midewiwin secret society around the North American Great Lakes came from ocean sources and were ritually 'shot' into initiates (Hoffman 1891) or used in a similar manner by other secret societies.

Regional networks

Although there are some minor stylistic differences from region to region, one of the more remarkable features of Upper Palaeolithic art is the widespread similarity over large distances and the prestige material exchange networks extending many hundreds of kilometres (Bahn 1982; Taborin 1993; Lacombe 1998; Beaune 1995: 198–9; Langlais 2010). This must represent continuing interaction between groups, and this has often been viewed in terms of the need for subsistence alliances and high mobility in resource poor areas with simple foragers like the Arctic Inuit (Gravel-Miguel 2011). However, such models have not proved consistent either with periods of climatic deterioration or with the proliferation of prestige items. In fact, in the Upper Palaeolithic, higher rates of interaction seem to occur with *improvements* in climatic conditions (Gravel-Miguel 2011), indicating a relationship of interaction and art with good resources. This is consonant with the secret society model based on the production of surpluses and wealth and regional interactions. Ethnographic secret societies are known for their regional networks involving mutual participation of high-ranking members from different communities in rituals, exchanges of rituals or paraphernalia and wealth, and other ritual interactions. These features seem to provide a better model for explaining widespread art similarities in the Upper Palaeolithic, especially given that the art primarily depicts power animals of importance to secret societies.

Esoteric knowledge

Surprisingly sophisticated astronomical knowledge and monitoring of celestial bodies has been inferred to have been utilized by people using painted caves. According to measurements taken by Jègues-Wolkiewiez (2000, n.d.), there is a very strong association between the orientation of painted cave entrances and solstice or equinox positions of the sun with the solstice sun illuminating far into the entrances of caves like Lascaux and Bernifal. The Blanchard plaquette also appears to be a record of the moon's phases together with its nightly highest points in the sky as they varied over several lunar cycles. The development of astronomical monitoring of important solar positions is common among complex hunter/gatherers and detailed astronomical knowledge has been recorded for secret societies in complex hunter/gatherer cultures like the Chumash (Hudson & Underhay 1968; Hayden & Villeneuve 2011).

Use of remote locations

Although some of the largest major art and ritual cave sites may also have been used as habitation sites (at least at the entrances), many of the major painted caves exhibit little or no evidence of habitation in or around the caves (e.g., Font-de-Gaume, Lascaux, Bernifal, Niaux). The location of special secret society meeting and ritual locations removed from habitation sites (but usually within a kilometre or two of residences) is entirely consistent with the use of caves by ethnographic secret societies. However, ethnographic secret societies also generally had special meeting and ritual places *within* or adjacent to the main residential communities. Therefore, in cases like Le Placard where there are impressive accumulations of what may be normal residential debris in the entrance, it is possible that some interior chambers in the dark parts of the cave were used as meeting places for secret societies within or near the community encampments.

Special burials

For the entire Upper Palaeolithic in Europe, only about 100–200 *intact* burials have been found, of which only 40 had any associated grave goods with some of the deceased elaborately adorned with shells, beads, and other items. (Beaune 1995: 175–9; Pettitt 2010). Thus, as on the Northwest Plateaux of North America (Schulting 1995), it seems evident that most people were not buried at death (Taborin 1993: 306; Pettitt 2010: 213). This raises the question of why so few individuals were buried. A number of the formal burials occurred in remote or hidden locations like the interior of Cussac Cave where the first remains were 180 m from the cave entrance. Moreover, as in Cussac, skulls were particularly selected for removal and curation (Aujoulat et al. 2002; Henry-Gambier et al. 2013; Guy 2017: 135, 161–4). This kind of special – often hidden – burial treatment of high ranking members (or their children) is typical of ethnographic secret societies including the retention of bones, especially skulls in hidden or difficult-to-access locations such as under megaliths. 'The idea is clearly to prevent the skull being stolen and an enemy using the mana inherent in it' (Speiser 1996: 275). In the Upper Palaeolithic, there is even an example of an human skull recovered from a stone coffer at Rond du Barry cave (Guy 2017: 164) that parallels the stone coffers (Fig. 8.6) used to house skulls used in secret society rituals in Vanuatu (Deacon & Wedgewood 1934:

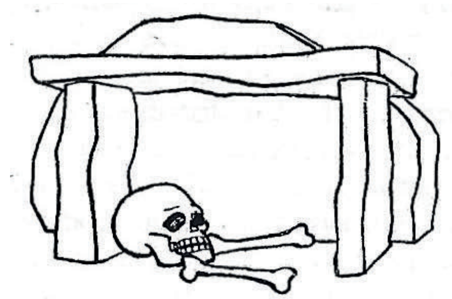

Figure 8.6. *A stone cist or small dolmen containing the skull of a high-ranking member of a secret society on Malekula Island, Vanuatu (Deacon & Wedgewood 1934: 447). This is notably similar to some Upper Palaeolithic skull and body burials in cists or small dolmens such as those at the French cave sites Rond-du-Barry and Saint Germain-la-Rivière.*

447) where skulls were widely curated, or hidden, or used in rituals by secret societies (Speiser 1996: 275–80, 319, 345; Deacon & Wedgewood 1934: 447, 546, 585). While some of these features might also be accounted for by ancestor cults, the attempt to hide burials, as in Cussac, is not consistent with known ancestor cult practices which generally attempt to display ancestral importance. Thus, I think the secret society framework is a more compelling explanation.

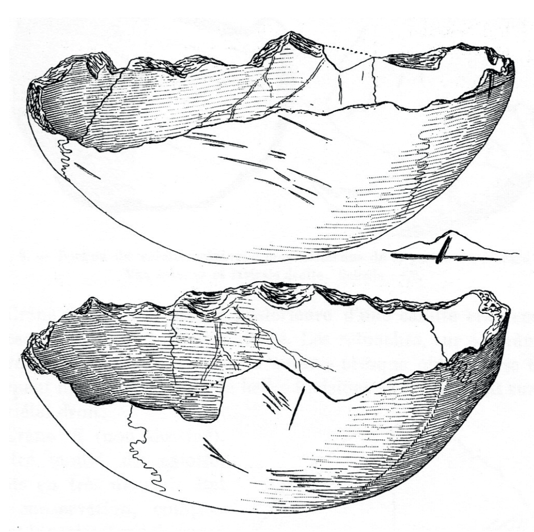

Figure 8.7. *One of the skull cups recovered from the Solutrean deposits in Le Placard (Breuil & Obermaier 1909: Fig 5). The edges have been carefully chipped into a bowl shape and cut marks on the temporal areas are clearly depicted. These skull modifications may have resulted from cannibalism or from the use of skull parts of deceased leaders of secret societies to obtain some of their supernatural power.*

Cannibalism

One of the surprises in my survey of ethnographic secret societies was the high incidence of cannibalism that was reported. While this was not a universal feature, it was nevertheless common. It is therefore interesting to note that there is strong evidence for cannibalism in a number of Upper Palaeolithic sites (Villa 1992, Saladié & Rodríguez-Hidalgo 2017: 1044–6). The modification of crania to form skull cups or bowls at Le Placard (Fig. 8.7), Gough's Cave, and Isturitz (Mort & Gambier 1991; Bello et al. 2015; Guy 2017: 162) could plausibly have been part of rituals involving cannibalism. In addition, Pettitt (2010: 216–17) stated that 40 percent of the human remains from the Upper Palaeolithic exhibited cutmarks. This may indicate a considerable level of cannibalism, but Guy (2017: 164) has argued for the use of such bones in ancestral rites. In contrast, Beaune (1995: 246, 251) presented evidence for human sacrifice, decapitation, and scalping in the Upper Palaeolithic. The issue needs further investigation, but it seems that at least in a surprising number of sites, cannibalism may have been part of the ritual practices in the Upper Palaeolithic, and one of the most plausible contexts was in secret society rituals.

Age and sex

On the basis of handprints, footprints, and finger flutings, both male and female children were evidently involved in some cave rituals (Beaune 1995: 196, 234, 237; Sharpe & Van Gelder 2005; Pastoors et al. 2015; Clottes 2016: 109–10). This age and sex profile matches the ethnographic age and sex profile documented for secret society initiates, at least for those children belonging to the most powerful families (Owens & Hayden 1997). In contrast, as Beaune (1995: 234) has noted, the young age of some of these children is not consistent with coming-of-age tribal initiations which are often invoked by prehistorians to explain the presence of children in caves.

Conclusions

No one of the criteria discussed in this chapter may provide iron-clad proof that secret societies existed in the more affluent Upper Palaeolithic communities. However, taken all together, these criteria provide compelling reasons for concluding that secret societies were, in fact, a major feature of many Upper Palaeolithic societies, especially those that produced notable art. By placing secret societies in the Upper Palaeolithic context, a number of the more puzzling features of Upper Palaeolithic archaeology become explicable, including the emphasis in art on power animals, the reason why deep caves were used for rituals, the varying distributions of animal motifs within and between caves, the infrequent and short duration of cave use, the procurement of exotic materials, the regional scope of the art and exchange network, the high investments in both hidden and public art, the special nature and paucity of burials, the special use of skulls, indications of cannibalism, and the young age of participants in cave rituals. What are the implications for other aspects of Upper Palaeolithic society?

It is currently fashionable in many parts of the world to view the first indications of ritual in the prehistoric record as having functioned to enhance community solidarity and group identity, whether in the Near East, in Europe, or in the American Southwest (e.g., Kuijt 1996, 2000: 145, 148; Goring-Morris & Belfer-Cohen 2008; Saitta 2013 – but see critiques for the Southwest by Ware 2014: 93). As may be appreciated from the preceding observations, ethnographers have pointedly emphasized that secret societies did *not* enhance social identities or community integration beyond their own membership or to promote greater support for the society. Rather secret societies existed to promote the self-interests and power of those in the highest positions in secret societies, and hence they were a major means of creating socioeconomic inequalities and social divisions. More than one ethnographer has referred to the use of terror to enforce the will of secret society leaders, and of the societies as 'terrorist organizations' (Drucker 1941). Anyone with ambitions or who wanted to protect their own interests, eagerly tried to amass wealth in order to become members, and advance as far as they could. Conflict and competition within and between societies was often intense including many attempts at poisoning.

Given the indications that secret societies operated in the Upper Palaeolithic and may have been responsible for the major decorated caves, this creates a profoundly different view of Upper Palaeolithic societies than is commonly held by many or most European prehistorians. Many of the other concomitant strategies used by ambitious aggrandizers in complex hunter/gatherer societies were also undoubtedly part of the socioeconomic fabric of Upper Palaeolithic groups in favourable environments. These aspects probably would have featured feasting, high marriage payments, elaborate debt networks, ancestor cults, the use of prestige items and animals, wealth exchanges, major socioeconomic inequalities, and the promulgation of elite ideologies including ownership over resource locations. In view of these considerations, I suggest that it is time for a fundamental reassessment of the nature of Upper Palaeolithic cultures.

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Chapter 9

Responses of Upper Palaeolithic humans to spatio-temporal variations in resources: inequality, storage and mobility

William Davies

Recognizing and quantifying degrees of inequality, storage and mobility in the Upper Palaeolithic is not a straightforward process. How long-lived were any instances of Upper Palaeolithic inequality, given the climatic and environmental instability of the period? Such environmental changes were significant, affecting the types/variety and abundance of resources within human lifetimes (e.g. van Andel & Davies 2003; Gamble et al. 2005). Thus, what were the potentials for establishing long-lasting inegalitarian socio-economic systems based on control of rich, predictable resources? 'Resources' include not just food resources, but those needed to fuel heat and light and make artefacts. People, in the form of labour and expertise (social knowledge), can also be seen as resources (Gamble 1999). Resources themselves can thus be mobile, stored and controlled. However, not all resources (e.g. secular skill and knowledge) were finite, temporally restricted or easily controllable, and thus not hoarded in some 'zero-sum' situation, whereby someone benefited at the expense of another.

Definitions of 'stratified societies' generally conflate social, economic and political inequalities, which are closely linked, but distinct, phenomena (Hayden 2008: 18). Socio-economic control can be exerted over resources and/or stored produce, or goods and exchange networks, while political control (over the work of individuals, etc.) can operate through many strategies (marriage/bride prices, exchange, extortion, war, rituals, feasts) (Hayden 2008: 22). Inequality is multi-scalar, from temporal to long-lasting (multi-generational), and from individuals to metapopulations. Long-lasting inequalities, operating at large (metapopulation) scales would only be sustainable if social institutions that could maintain consistent aims were present. Without such institutions (including communal belief systems), stability could not be sustained or coerced, and every action or plan would need to be negotiated, or renegotiated in the case of unforeseen events.

The long-term socio-economic basis for structural inequality, even transegalitarianism (Table 9.1), has often been linked to resource predictability and abundance (e.g. Dyson-Hudson & Smith 1978; Marean 2015, 2016; Hayden 2003). Foragers located in areas with predictable and abundant resources are, according to this model, more likely to be sedentary and territorial, e.g. Pacific Northwest Coast groups that rely on obtaining and storing large quantities of fat-rich anadromous fish (primarily salmon). Some authors, e.g. Bordes & de Sonneville-Bordes (1970), have suggested that the environmental conditions of Northwest North America *might* have been analogous to those in Upper Palaeolithic Europe. In this paper, I will examine the following questions:

- Can we be sure that the productivities of Upper Pleistocene European environments resembled those known for forager societies today (cf. Hayden 2008: 81)? (The implications of 'non-analogue' ecological communities will also be considered.)
- Could socio-economic complexity have existed without a resource base that generated consistent surpluses?
- Was cosmological or ritual knowledge directly founded/dependent on productive biotic resources, and might it have been easier to control than technical knowledge?

Control of ritual knowledge can be found in extant forager groups, often based on gender and age, without necessarily leading to clear patterns of inegalitarianism or transegalitarianism, e.g. Kalahari San or Australian Aborigines (Cashdan 1980; Woodburn 1982, 2005; Testart 1989; Boehm 1993; Layton 2005; Hayden 2008).

The spectre of equifinality (several possible explanations for a pattern) thus haunts our interpretations: what can our data tell us unequivocally, and how should we incorporate ethnographic parallels into our analyses?

Testing for inegalitarianism in the Upper Palaeolithic record

The key egalitarian and transegalitarian categories (Table 9.1) form a continuum of variation (through to full structural inequality), though they should not be interpreted as an evolutionary succession. Societies within each broad category vary in the intensity and expression of their traits, and all have their own contingent history. We shall explore the extent to which we can, and should, generalize from both ethnographic and archaeological data, and how we should link the two lines of evidence (if possible or desirable). Table 9.2 outlines how transegalitarian social traits might be tested archaeologically. It is important to identify possible sources of *equifinality* in our evidence: how confident can we be in asserting that specific traits (or combinations of them) are diagnostic of structural inequalities, or can they be explained in other ways? Are some traits better at indicating inequality than

Table 9.1. *Defining key terms of reference.*

Egalitarian societies (Testart 1982; Woodburn 1982; Zubrow 2010)	Active and systematic elimination of distinctions (except those of sex) based on wealth, power and status. Individuals have influence, but no power, and hierarchies (e.g. of knowledge) can exist in egalitarian contexts. Zubrow (2010: 113–14): equality has different scales (proportional/ relative vs. quantitative/absolute) and dimensions (horizontal vs. vertical distinctions (or not) in treating individuals in a group). He identifies five models of equality (pp. 114–16): 1. Equal treatment for all (no preference of provision or receipt; blind equality in how an individual relates to others/groups/social institutions; all expected to have same baseline abilities, even if they do not). 2. Equal outcome (initial conditions are not important, but results should be equal: egalitarianism of ends, not means; assumed that individuals are diverse, and have variable opportunities – often from no control over circumstances; different preferences might influence the equality outcome; difficult to organize beyond the local scale). *Reduces the differences among households and individuals over time.* 3. Equal opportunity (for everyone to develop their own talents; equal rewards for equal performances – the 'opportunity to try,' not the 'opportunity to succeed'; permits a divided and hierarchical society, predominantly organized around individualism; accepts that not all talents are equally valued by society; socially conservative, in that there is prior acceptance of a social order of value). *Over time, inequality will increase, by following meritocratic principles, even though no-one is denied the opportunity to participate.* 4. Equality of resources (all individuals treated as equal – no further transfers of resources will make them more equal; there is a potential difference between private and public resources, and no division of resources is equal if, after division, anyone would prefer someone else's portion of resources, goods and services). The market is needed to recognize one's socio-economic position, but it can also lead to individuals monopolizing/maximizing their position (though not always at the expense of others). 5. Equality of welfare (all are equally successful, with equal, though heterogeneous, enjoyment from life; goal is to achieve the greatest average welfare, as long as this does not detract from the fair shares of others, but it is unclear how this model allows resource provision for those with disabilities). If anyone develops more expensive tastes than others, or is pessimistic rather than optimistic, more resources will be needed for equal success or enjoyment.
Transegalitarian societies (Owens & Hayden 1997; Hayden 1995, 1998, 2008)	Between egalitarian and inegalitarian societies, and equivalent to 'complex' hunter-gatherers, e.g. Pacific Northwest Coast (cf. Table 9.2). Created by 'aggrandizers', who range in intensity from **Despots** (relatively egalitarian: no stratification as the position is ephemeral; duplicated across settlements and households; some surplus-based corporate kin groups; feasting used to build alliances; compensation payments made to allies for death in conflict; operative in only one or two realms, e.g. warfare and production), to **Reciprocators** (overtly non-egalitarian: leaders competing within the community, so some stratification within corporate groups; moderate heredity of positions; strategies for creating debts, surpluses and power, including bride-wealth, more elaborate feasts, and perhaps child growth payments; minor public, feasting or ritual community architecture; surplus-based corporate groups, whose aggrandizers have increased wealth, more wives and larger social networks), to **Entrepreneurs** (clear evidence of institutionalized inequality; strong heredity and stratification within corporate groups; non-monumental community architecture; some community cult architecture; duplicated corporate monumental architecture; surpluses used in competitive feasts to create contractual debts, involving interest payments; loans and investments are the primary means of obtaining wealth and power; warfare is less important, as it interferes with generation of surplus and exchange; marriage used to transfer wealth through bride-payments; aggrandizers consolidate control of a wide range of leadership roles, e.g. military, ritual, financial/economic).

Table 9.2. *Characteristics of 'Generalized' (egalitarian) and 'Complex' (transegalitarian) hunter-gatherers (modified and augmented from Hayden 2003: 125 & 2008: 15-16; also Owens & Hayden 1997, Testart 1982). Reference to archaeological indicators given by numbers in parentheses for relevant characteristics; my additions (numbered) given in italics.*

	'Generalized' hunter-gatherers	'Complex' hunter-gatherers
Resources	• Limited (1–3, 5, 6); • Fluctuating & vulnerable (1–3, 5, 6); • No storage (2, 3, 6); • No small or secret/concealed resources (3, 4)	• Abundant (1–3, 5); • More stable (2, 3) & invulnerable (1–3, 5, 6); • Storage (2, 3, 6); • Small or secret/concealed resources are important (3, 4)
Population density (person/100 sq. km)	1–10 (5, 6)	10–1000 (5, 6)
Annual mobility	Nomadic foraging (6–9)	Full or semi-sedentism (6–10)
Social & ideological adaptation	• No individual ownership (2, 4, 7, 11); • Sharing; no economic competition (1?, 7, 11?, 13); • Egalitarian society (1–4, 9–11, 13); • Alliances (11?, 12); • Sporadic revenge raiding (14)	• Private property/resource ownership (1, 4, 7, 8, 12, 13, 14); • Economic competition, and specialization (1–3, 4?, 7); • Hierarchical society, and poor vs. wealthy (4, 7, 8, 10, 12?, 14); • Economic trade (13); • Slavery (14?); • Increased warfare (15)
Archaeological indicators	1 *Little/no evidence of resource intensification;* 2 Generalized technology; 3 Few/no storage features or resources (pits, caches, smoking/drying hearths, filleting using blades; grease extraction); 4 No remains from small secret/concealed resources, and little/no technology for them; 5 Simply structured, small sites, with thin deposits; 6 Fine-grained spatial distribution of sites; 7 No permanent architecture; 8 *Seasonality indicators (plants & animals), including fruits/seeds, tooth cementum, etc.;* 9 *Isotopic and skeletal signatures of dietary status, activity and mobility by age and sex;* 10 *Ancient DNA evidence of effective population structure.* 11 No primitive valuables; 12 *Informal exchange items;* 13 No rich burials; 14 *Individuals with perimortem injuries.*	1 *Management and intensification of favoured resources;* 2 Specialized, complex technology; 3 Significant storage features (pits, caches, smoking/drying hearths, filleting using blades; grease extraction); 4 Remains of small concealed/secret resources, and specialized technology for them; 5 Large, structured, sites with thick, dense artefact deposits; 6 Patchy spatial densities of sites; 7 Permanent architecture, *e.g. monuments, terraforming, restricted private spaces*; 8 Ancestor cults: mortuary practices, body-part 'talismans,' body modification, secret art; masks; 9 *Seasonality indicators (plants & animals), including fruits/seeds, tooth cementum, etc.;* 10 *Isotopic and skeletal signatures of dietary status, activity and mobility by age and sex;* 11 *Ancient DNA evidence of effective population structure.* 12 Primitive valuables (status items, jewellery, etc.); 13 Regional trade networks; 14 Rich vs. poor burials; 15 Cemeteries with high levels of violent deaths.

others, or is the evidence from a particular trait more convincing than from *combinations* of traits (as listed in Tables 9.1 and 9.2)? If either of those situations could be demonstrated, what are the implications for our reconstructions of Upper Palaeolithic inequality?

It is worth noting that the simple linear transition sequence of control ⇒ power ⇒ wealth ⇒ inequality ⇒ hierarchy (with power deriving from varying control of natural resources, property, labour and production, ritual, exchange networks, etc.) is tautologous. '*Control is power* rather than simply a means to power', as Clark (1998: 501) observed, so how did emergent control/power arise in the first place? Egalitarian societies actively squash any attempt to monopolize resources, labour, ritual, etc. (Cashdan 1980; Woodburn 1982, 2005): what, therefore, might prompt group members to tolerate an appropriation of communally held rights? Could it have arisen through elaboration of ritual knowledge and rights, as postulated by Woodburn (1982, 2005) for delayed-return societies (Appendix A),[1] or were the causes economic or socio-political (e.g. Cashdan 1980; Hayden 1998, 2003; Zubrow 2010: 117)? The option of group fission would surely have been available to Palaeolithic foragers as a means of conflict-resolution, or for escaping the dictates of a despot (Table 9.1), unless something were to restrict that option (e.g. population packing in adjoining areas or topographic barriers: Boone 1992: 312–13). The concept of 'motility' (Weig 2015: 423) is key to this discussion (see p. 145).

As will be discussed below, it is not clear that either topographic or environmental barriers, or population packing, were significant factors in the Upper Palaeolithic. The major basis of the assertion that transegalitarianism was present in the Upper Palaeolithic, and indeed drove many of its innovations via the whims of 'Big men,' is that resources were rich in western Eurasia, allowing the production of surpluses that could be controlled (Owens & Hayden 1997: 123; Hayden 2003, 2008). However, the term 'surplus' is a slippery one: are we discussing the stockpiling of abundant, but temporally restricted, resources to provide essential subsistence in periods of dearth (Layton 2005), or a constant withdrawal and storage (probably monopolized) of superfluous resources throughout the year, which could then support a non-producing class? Zubrow (2010: 117) has argued that unequal status began in the Upper Palaeolithic, owing to the way resources were distributed within and between groups, rather than through the richness of resources generally or the nature of production. Different ways of sharing, and of using space, would also potentially cause the development of inequalities (Zubrow 2010).

Woodburn's (1982, 2005) immediate- and delayed-return systems form two poles of a socio-economic continuum (Appendix A), and some forager societies (notably in Australia) have traits from both extremes (Woodburn 1982, 2005; Riches 1995). This led Layton (2005: 140) to sub-divide the delayed-return pole by separating seasonal fluctuation in productivity from territorial patterning. Layton reminds us that while highly seasonal distributions of resources may require complex technology and storage of food to equalize food supply across the year, they do not of themselves always lead to elaborate social organization. Inuit may have complex technology, but are essentially egalitarian: there is flexibility of movement within communities, and no descent-group claims over particular parts of the group's territory. Meat-sharing is restricted to family groups in summer and co-operating hunters (only in winter is food shared throughout the co-resident extended family); levelling transactions enforce the redistribution of material goods between households if some are thought to have too much (Layton 2005: 139). While some (mostly central and northern) Australian Aborigines practise clan totemism and strategic inter-clan marriage alliances (Woodburn 1982, 2005; Riches 1995), their technology is generally simple, and there is flexible movement between bands (Layton 2005: 139). Inherited membership of a totemic clan only gives exclusive rights (through initiation) to enter sacred sites, wear totemic paintings during restricted ceremonies and curate its sacred objects; it does not confer exclusive hunting and gathering rights (Layton 2005: 140). Water is the resource that governs logistical movement in desert conditions (e.g. southern Africa and much of central and western Australia), with predictable sources being localized and uncommon; otherwise, reciprocal access to clan territories is practised, to reduce risk from unpredictable resources and rainfall (Layton 2005: 140). If no transfer of resources from seasons of surplus to ones of shortfall occurs, then maximum populations must lie below the lean season's minimal productivity (Layton 2005: 133): effectively Liebig's law of the minimum. Inter-season transfers of resources allow maximal populations to rise slightly (up to the median productivity between the seasonal extremes) (Layton 2005).

These should all be borne in mind when evaluating the environmental impact on European Upper Palaeolithic societies, which covered a wide range of often rapidly changing environmental types, from drier conditions in the Mediterranean to more temperate and colder conditions at higher latitudes. Climatic fluctuations also affected the distribution of resources (including water); it is worth noting that the Last Glacial Maximum was not just relatively cold, but that levels of precipitation declined in many regions (Clark et al. 2009; Heyman et al. 2013; Monegato et al. 2015).

Environmental contexts of late Pleistocene western Eurasia

The assumption that environments in the European Upper Palaeolithic were richly resourced is key to the argument that the production and accumulation of surpluses (owing to the nature of resources and technological improvements in hunting and processing equipment) enabled the development of socio-economically complex, transegalitarian societies in this period (Owens & Hayden 1997: 123; Hayden 1998; 2003: 123, 129–30). The plains of western Europe comprised prairies of unequalled richness,[2] with abundant prey (Hayden 2008: 82, after Bordes 1969: 128). By analogy with Pacific Northwest Coast Indians, whose economies are founded on large salmon migrations, Hayden (2003: 81) argued that large reindeer migrations were the equivalent seasonal surplus resource harvested and stored by transegalitarian Upper Palaeolithic foragers. The supposed rich hunting grounds of southwest France, northern Spain, northern Italy and the Russian Plain are used to explain the high development of art, wealth, complexity and ritual (Hayden 2003: 129–30; 2008: 82). These generalizations, though, conceal considerable variation in the nature of food resources in those four regions. The Upper Palaeolithic records of northern Spain and northern Italy are not marked by (significant) reindeer remains; most of the ungulates were relatively sedentary and territorial, e.g. red deer.

In addition, reindeer are not a simple terrestrial analogue for salmonids. While the extent to which salmonids are r-selected (Hayden 1981) is debatable – while they reproduce once, followed by the catastrophic mortality of the reproducing generation, they also live several years, develop slowly, reproduce late, have relatively large size, and are affected by competition – reindeer are clearly at the K-selected end of the spectrum (Pianka 1970: 593; Parry 1981). Modern *Rangifer* have two main ecotypes, and studies of Upper Palaeolithic specimens are needed to establish which reindeer ecology was targeted at each Upper Palaeolithic site. Woodland reindeer form relatively small herds and undertake restricted seasonal migrations, while tundra reindeer form much larger aggregations and migrate extensively (Burch 1972). The latter type migrate in long files of individuals that do not follow the same routes each year (Burch 1972: 351): they are thus unpredictable. This unpredictability is compounded by the dynamics of reindeer populations, which can fluctuate greatly in size over cycles of 25–100 years (Burch 1972: 359), owing to factors such as food supply, climatic and local weather conditions, and parasites (Solberg et al. 2001; Albon et al. 2002; Uboni et al. 2016). Reindeer movements might be consistent and well-patterned for a few years, and then suddenly shift (within a year), perhaps by 800 km, owing to changes in snow conditions *en route*: good news for hunters in the new destination, but disastrous for those in the previous location, expecting a reindeer bonanza (Burch 1972: 354). A limited series of isotopic studies have been carried out so far, indicating presence of reindeer of the aggregating and migrating ecotype at Jonzac, southwest France (Quina Mousterian: 68–81 ka) (Britton et al. 2011; Niven et al. 2012; Richter et al. 2013), and Stellmoor, north Germany (Hamburgian, *c.* 15.0–14.0 ka, and Ahrensburgian, *c.* 12.8–11.4 ka) (Price et al. 2017).

These strontium results might appear to support Hayden's (2003) assertion that reindeer in southwest France ('Dordogne') were intercepted and harvested in bulk during their autumn aggregation migration to their wintering grounds. However, a combination of antler, dental development and wear, and foetal long bone evidence (Fontana 2017) indicates that during the Gravettian, Solutrean and Magdalenian (at the well-known sites of Abri Pataud, Laugerie-Haute, Badegoule, Fourneau du Diable, La Madeleine, and possibly Combe-Saunière), reindeer were hunted throughout the year in the period *c.* 30–15 ka. Magdalenian IV and V layers at La Madeleine indicate reindeer hunting in at least five periods of the year, across all four seasons (Fontana 2017: 353). This pattern contrasts with the evidence from the Aude basin (winter/spring hunting) and the Paris Basin (autumn hunting) for the Magdalenian.

The evidence for relatively sedentary reindeer in the Périgord region forces reinterpretation of the proximity of several Magdalenian sites to natural fords (White 1985). Reindeer crossings near La Madeleine and Laugerie-Haute (White 1985: 125) would have occurred several times a year, and in small herds rather than in large aggregations. Modern reindeer can swim extended distances (at least 6.5 km: Burch 1972), and unless the Vézère was particularly fast-flowing during the classic Magdalenian, it is unlikely that reindeer were restricted to natural fording places in the river (cf. Burch 1972: 347; White 1985: 129–30). Thus, *contra* Hayden (2003), it is difficult to argue for mass intercept kills of migrating reindeer aggregations in southwest France on current evidence; instead of labour-intensive processing and storage of large quantities of meat in a few short periods during the year, annual supply of reindeer seems to have been more evenly distributed. Did that obviate the need for storage, as temporal fluctuations in supply were not pronounced? The lower quantities of reindeer available in the Périgord would restrict the amounts that could have been harvested and stored, but perhaps there might have been targeted exploitation of reindeer in August, when hides and meat were in prime condition (Burch 1972: 359)? Fontana's (2017: 355) estimates of seasonality indicate July and August hunting events for La Madeleine levels 27 (Magdalenian IV) and 25 (Magdalenian V), respectively.

Elsewhere, e.g. the North European Plain Magdalenian, and at other times, e.g. the Weichselian Middle Palaeolithic of southwest France, seasonal intercept hunting of reindeer herds was practised (Price et al. 2017; Britton 2011). Whether the reindeer in those two examples were long-distance migrants, or moving between different biomes within the same broad region, is more debated (cf. Britton et al. 2011; Price et al. 2017: 384). The large reindeer assemblages from the lateglacial sites of Meiendorf and Stellmoor (north Germany) appear to mix different ecotypes: some had relatively restricted ranges, and others moved long distances between distant summer and winter ranges (implied by larger inter-tooth $\delta^{18}O$ differences and more strontium variation than seen in less-migratory individuals) (Price et al. 2017). Given the essentially homogeneous strontium values for the North European Plain, which are matched by values seen in the reindeer teeth and antlers (implying reindeer did not stray from the region), it is the $\delta^{18}O$ and $\delta^{13}C$ values that give some indication of climatic conditions and dietary intakes. On that basis, Price et al. (2017) argue that summer grazing pastures were east of Meiendorf and Stellmoor, with hunters intercepting them as they shifted westwards in late summer/early autumn. The variable isotopic values between and within Stellmoor reindeer suggest varying herd densities (and compositions) in the vicinity, and that the site might have been positioned centrally within a herd range during the lean season(s), rather than on a migration path (Price et al. 2017; cf. Burch 1972: 351).

The evidence considered so far would imply that the migratory patterns of late Pleistocene reindeer were more variable than those seen in modern populations (Price et al. 2017: 388–9), and this would have implications for Hayden's interpretation of reindeer as a rich, storable, resource in the Upper Palaeolithic, not just in terms of their migratory predictability, but also in their seasonal availability/quantities. Hayden's (2008: 82) two exploitation models for large-scale hunting – intercept hunting of big migrations versus hunting of less-mobile, spatially restricted prey – can thus both be applied to late Pleistocene reindeer. Given shifts in prey behaviour over time and space, both strategies can sometimes be found at the same sites, e.g. Stellmoor, where small-scale hunting of reindeer is recorded (drives or stalking of small groups, whose carcasses were then intensively exploited) in the Hamburgian (Magdalenian), while in the Ahrensburgian, large-scale ambush hunting (taking many individuals while they were in the water, and butchering the carcasses selectively) occurred (Bokelmann 1991; Bratlund 1991, 1996; Price et al. 2017). Burch (1972: 363) estimated a processing time of several days for up to 12 people to process kills from the huge aggregations at Meiendorf or Stellmoor. The Ahrensburgian layer at the latter site had a Minimum Number of Individuals (MNI) of 302 reindeer, which were selectively filleted (perhaps to save time – cf. Burch – and to minimize interest of other carnivores) (Bratlund 1996), plus another 12 almost complete skeletons (Price et al. 2017). Late summer/early autumn would have been a good time for quickly air-drying thin strips of filleted meat for later consumption, as well as processing prime-condition hides (Burch 1972). The unused portions of most carcasses, plus the 12 that were not exploited at all, seems to argue against the controlled production of surpluses by individuals or families: why were returns not maximized? However, it is possible that these carcasses might have been anchored to the bottom of the lake with rocks to store them for a future need that ultimately did not arise (Speth 2017: 60). This large-scale hunting of reindeer can still be explained as an aggregation of hunters designed to produce a seasonal surplus (either filleted or stored underwater) to mitigate shortages during lean seasons. Similar patterns of indiscriminate slaughter in strategic parts of the landscape, followed by selective butchery, have been documented for Neanderthals (synthesized in White et al. 2016), so there seems little to distinguish Neanderthals from modern humans in this regard (cf. Hayden 2003). Firm evidence of controlled access to surpluses in the Middle and Upper Palaeolithic eludes us at present, and it is not clear what this evidence should look like, or how it could be measured: hearths can be used for multiple purposes over their use-lives, and no drying rack evidence has been recovered.

The economic alternative to storage based on specialization in migratory species is resource-spectrum broadening (both plants and animals), seen in both Neanderthals and Upper Palaeolithic modern humans (e.g. Freeman 1981; Berganza et al. 2012; Pétillon 2016; Pryor et al. 2013; Costamagno & Laroulandie 2004; Stringer et al. 2008; Hardy et al. 2013; Henry et al. 2014). The taxa exploited, and their relative quantities, are highly spatio-temporally variable, but all show evidence of cut-marks, disarticulation, burning/cooking and human tooth marks. Often taxa were used for products (feathers, talons, bones, teeth, fur/hides, etc.), as well as being consumed: were such resources (particularly mammalian and avian carnivores) consumed more for symbolic purposes than nutritional ones? If the former, then who was involved in the consumption (the whole group, or a sub-section of it)? Fish consumption evidence is present in both late Middle Palaeolithic and Upper Palaeolithic assemblages, seemingly becoming more economically important in the lateglacial (Magdalenian) (e.g. Costamagno & Laroulandie 2004). To what extent did the collection of such resources dictate the positioning of sites, perhaps near fording places (e.g. White 1985: 131)?

Marine mammals, such as whales, also seem to attain a new importance in the Magdalenian of Franco-Cantabria, being not only depicted in art (Fritz & Roussot 1999: 82–3), but also turned into bone tools (Pétillon 2016). The fat and meat content of these beached whales would have been a great bonus to groups living near the Atlantic coast, although we cannot know if the blubber was stored/matured in bogs and streams, as it was in Tierra del Fuego (Moore 1980; Jackson & Popper 1980). Fuegian Yaghan groups could expect one or two whale beachings per year, and groups would aggregate to process the carcass (Jackson & Popper 1980). The circulation of whalebone projectile tips far inland from the Atlantic coast in Magdalenian France (Pétillon 2016) might have been the result of exchange, or direct procurement by a variety of groups.

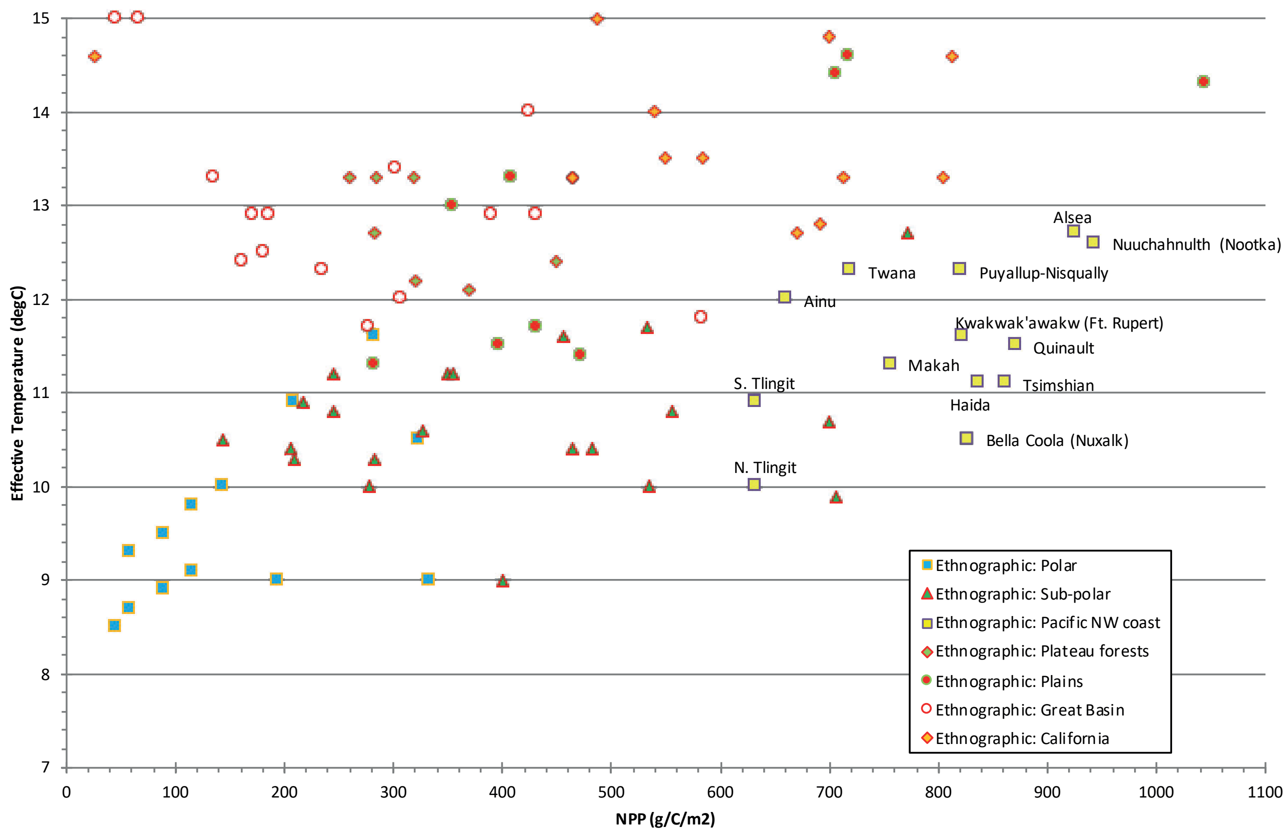
Environmental productivity

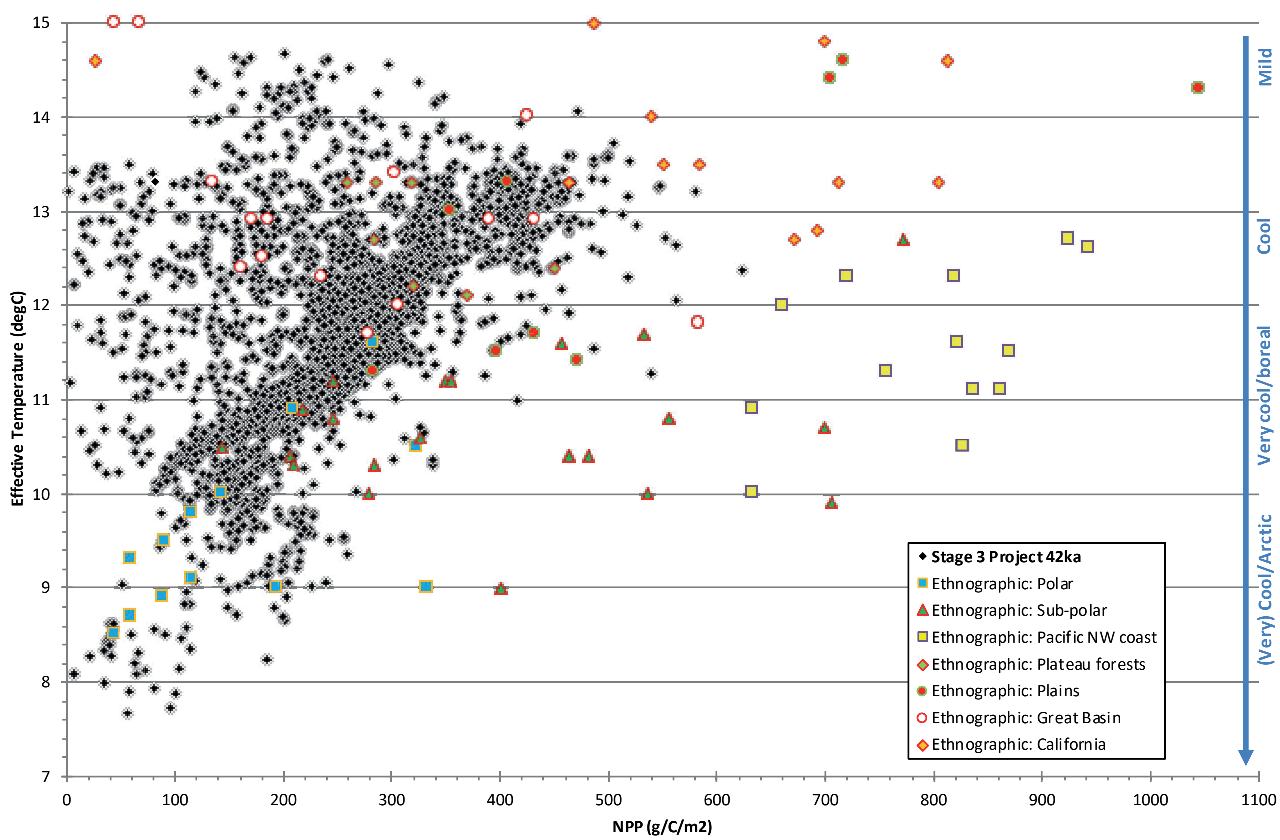
While Upper Palaeolithic foragers appear to have had a wide range of exploitation strategies (from relatively specialized to broad-spectrum), it is still not clear whether any surpluses stored were for anything more than time-scheduling of resource extraction and consumption to account for fluctuations in supply (Ingold comment, in Testart 1982: 532), or alternatively to augment or provide variety to an otherwise monotonous diet (Moore 1980; Jackson & Popper 1980). We should note that species exploited, and the quantities recovered for each taxon, do not of themselves tell us about environmental productivity. Instead, they tell us about the broad choices and preferences of the occupants of a particular locale, though occupation duration and palimpsest activity will have an effect on patterning. To this end, we should consider environmental primary productivity from regional models of Marine Oxygen Isotope Stages (MOIS) 3 (*c.* 59–25 ka) and 2 (*c.* 25–11.5 ka) (periodization and models will be based on Stage 3 Project data (van Andel & Davies 2003), as they were available for analyses). There have been several such projects over the last twenty years (van Andel & Davies 2003; Allen et al. 2010; Huntley et al. 2013; Tallavaara et al. 2015; Burke et al. 2017), and they allow us to use climatic and environmental models to compare productivity over time and space with uniform data and methods.

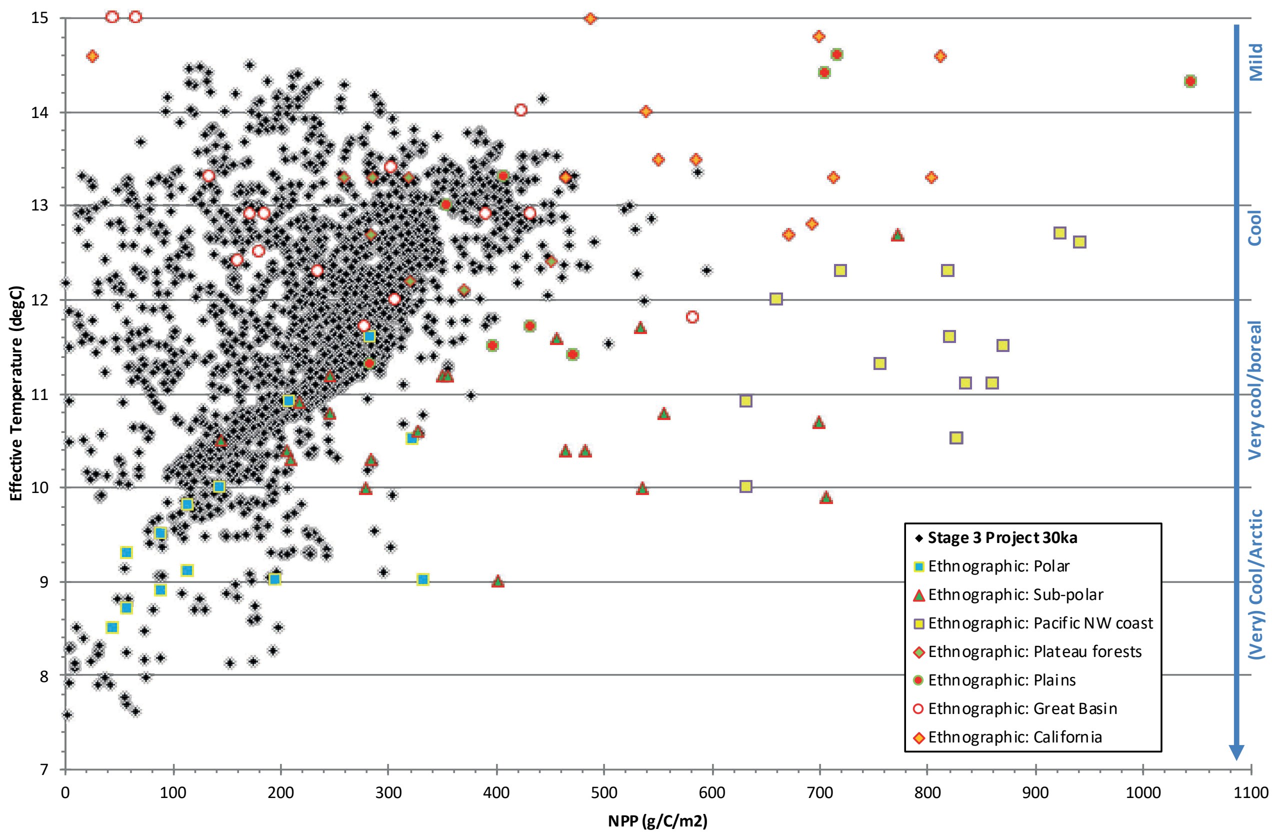
Binford (2001) and Kelly (2013) have both plotted modern fisher-hunter-gatherers against local Net Primary Productivity (NPP: estimating the amount of new plant growth within a given area over time (grammes of carbon per sq. m per year)) and Effective Temperature (ET: a measure of the length of the growing season in a location, and its intensity of solar energy (Bailey 1960; Binford 1980, 2001)). The ETs seen in Figures 9.1 and 9.2 (and Appendix B) comprise values for ethnographic groups (Binford 2001; Kelly 2013), and for each 60 x 60 km cell in the Stage 3 Project Regional Climate Models for 42 ka ('Stable Warm'), 30 ka ('Cold') and 21 ka (Last Glacial Maximum ('LGM')) (see van Andel & Davies 2003). Given that the ethnographic values presented here mainly derive from mid-to-high latitudes, it is unsurprising that their levels of seasonal insolation are similar to those estimated for similar latitudes in late Pleistocene Europe. The boxplots for the three Pleistocene simulations cover a wide range of ET values, from 'very cold' (Bailey)/'Arctic' (Binford) to 'mild' (Bailey)/'warm temperate' (Binford) (Bailey 1960: 7–8; Binford 1980: 14), although the interquartile ranges for 42 ka and 30 ka perhaps most resemble those for the Pacific Northwest Coast, partially overlapping also with ETs for the North American Plains, Great Basin, Plateau forests and Sub-polar environments. The LGM simulation ET interquartile range shows clearer similarities with the Pacific Northwest Coast and Sub-polar environments. At face value, this would support Hayden's (2003, 2008) contention that the Pacific Northwest Coast is an analogue for the European Upper Palaeolithic. However, the situation becomes more complex when we focus more on ET values for key regions of the European Upper Palaeolithic (e.g. Cantabria, southwest France and Moravia), and when we consider NPP. The cells in the Stage 3 Project simulations containing key Cantabrian Upper Palaeolithic sites have surprisingly low ET values (tending to Bailey's 'very cool,' or Binford's 'boreal,' category, shifting towards 'cold'/'Arctic' at the LGM (21 ka)). Only the similarly westerly and maritime-influenced site of Paviland shows similar values (akin to those seen today for Polar and Sub-polar foragers). Further to the east (southwest France, Moravia and the site of Sunghir), ETs are generally higher, falling within the 'cool,' or upper range of Binford's 'boreal,' category. Any similarity in ET values to those seen in today's Pacific Northwest Coast from the selected regions in this paper (southwest France, Moravia and Sunghir) is terminated by the LGM, when ET values drop (Fig. 9.2, Appendix B).

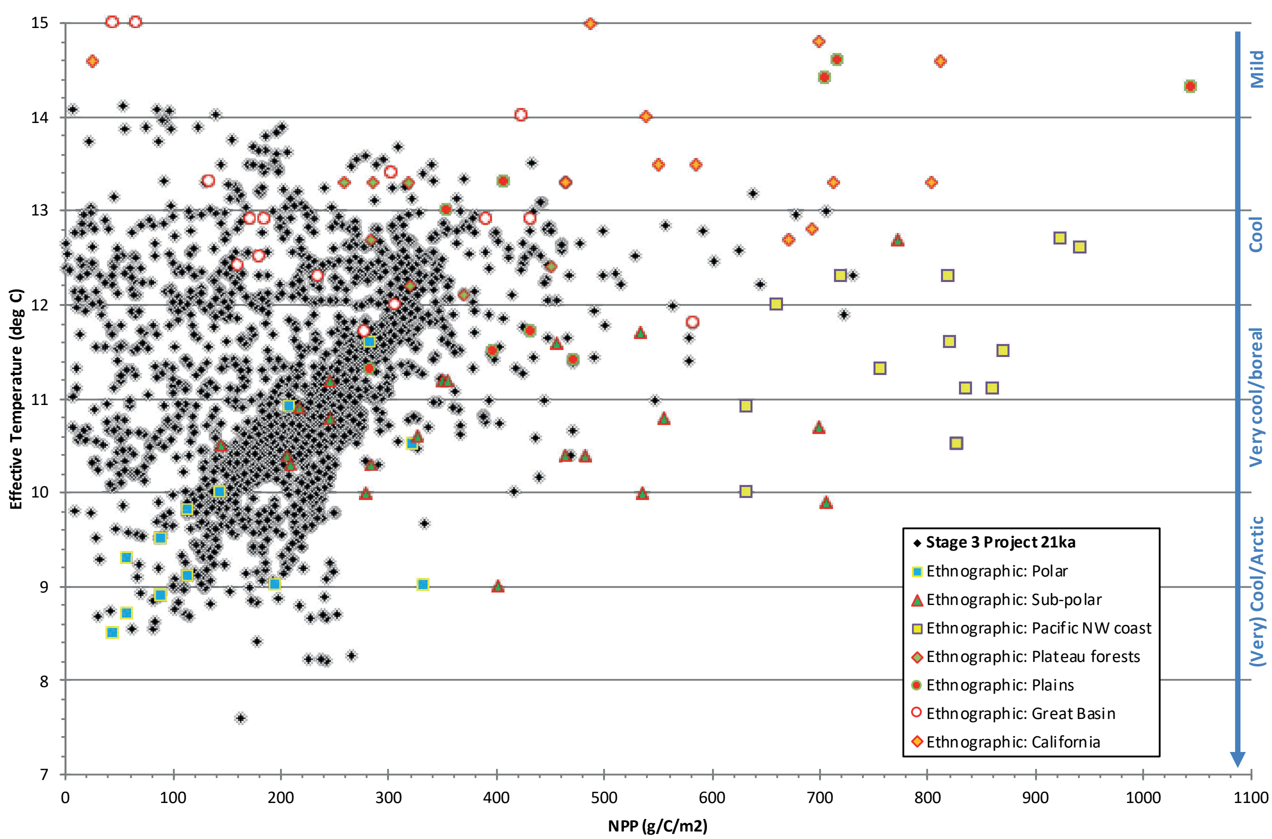
NPP, as can be seen in Figures 9.1 and 9.2, does not show such a clear latitudinal and longitudinal pattern. Overall in Europe, there is a slight drop in mean and median NPP between 42 ka and 21 ka, but what is most striking is the lack of productivity overlap between late Pleistocene Europe and present-day Pacific Northwest Coast (Figs. 9.1, 9.2; Appendix B). As indicated in the ET values, Cantabria and Paviland also show depressed NPP values (similar to those for current Polar foraging groups), which perhaps are the result of relatively consistent temperatures: while most days each year seem to have been above 0°C (Cantabria, 42 ka: 11–12 months; 30 ka: 9–12 months;

Figure 9.1 *(overleaf). Net Primary Productivity (NPP) and Effective Temperature (ET) conditions for extant fisher-hunter-gatherers, in comparison to reconstructed NPP and ET values for Upper Palaeolithic Europe (42 ka [stable warm conditions], 30 ka [cooling conditions] and 21 ka [LGM]). ET categories (Bailey 1960: 7–8): Mild (13.4–15.5 °C), Cool (11.6–13.4 °C) and Very cool (10.0–11.6 °C) (cf. Binford's (1980: 14) 'Warm temperate' = 14.0–15.9 °C, 'Cool' = 12.0–13.9 °C, and 'Boreal' = 10.0–11.9 °C); Cold (8.6–10.0 °C), Very cold (7.5–8.6 °C) and Glacial (below 7.5°C) (cf. Binford's (1980: 14) 'Arctic' = 8.0–9.9 °C).*


Effective Temperature (degC)
NPP (g/C/m2)
Alsea
Nuuchahnulth (Nootka)
Twana
Puyallup-Nisqually
Ainu
Kwakwak'awakw (Ft. Rupert)
Quinault
Makah
S. Tlingit
Tsimshian
Haida
Bella Coola (Nuxalk)
N. Tlingit
Ethnographic: Polar
Ethnographic: Sub-polar
Ethnographic: Pacific NW coast
Ethnographic: Plateau forests
Ethnographic: Plains
Ethnographic: Great Basin
Ethnographic: California


Effective Temperature (degC)
NPP (g/C/m2)
Mild
Cool
Very cool/boreal
(Very) Cool/Arctic
Stage 3 Project 42ka
Ethnographic: Polar
Ethnographic: Sub-polar
Ethnographic: Pacific NW coast
Ethnographic: Plateau forests
Ethnographic: Plains
Ethnographic: Great Basin
Ethnographic: California


Effective Temperature (degC)
NPP (g/C/m2)
Mild
Cool
Very cool/boreal
(Very) Cool/Arctic
Stage 3 Project 30ka
Ethnographic: Polar
Ethnographic: Sub-polar
Ethnographic: Pacific NW coast
Ethnographic: Plateau forests
Ethnographic: Plains
Ethnographic: Great Basin
Ethnographic: California


Effective Temperature (deg C)
NPP (g/C/m2)
Mild
Cool
Very cool/boreal
(Very) Cool/Arctic
Stage 3 Project 21ka
Ethnographic: Polar
Ethnographic: Sub-polar
Ethnographic: Pacific NW coast
Ethnographic: Plateau forests
Ethnographic: Plains
Ethnographic: Great Basin
Ethnographic: California

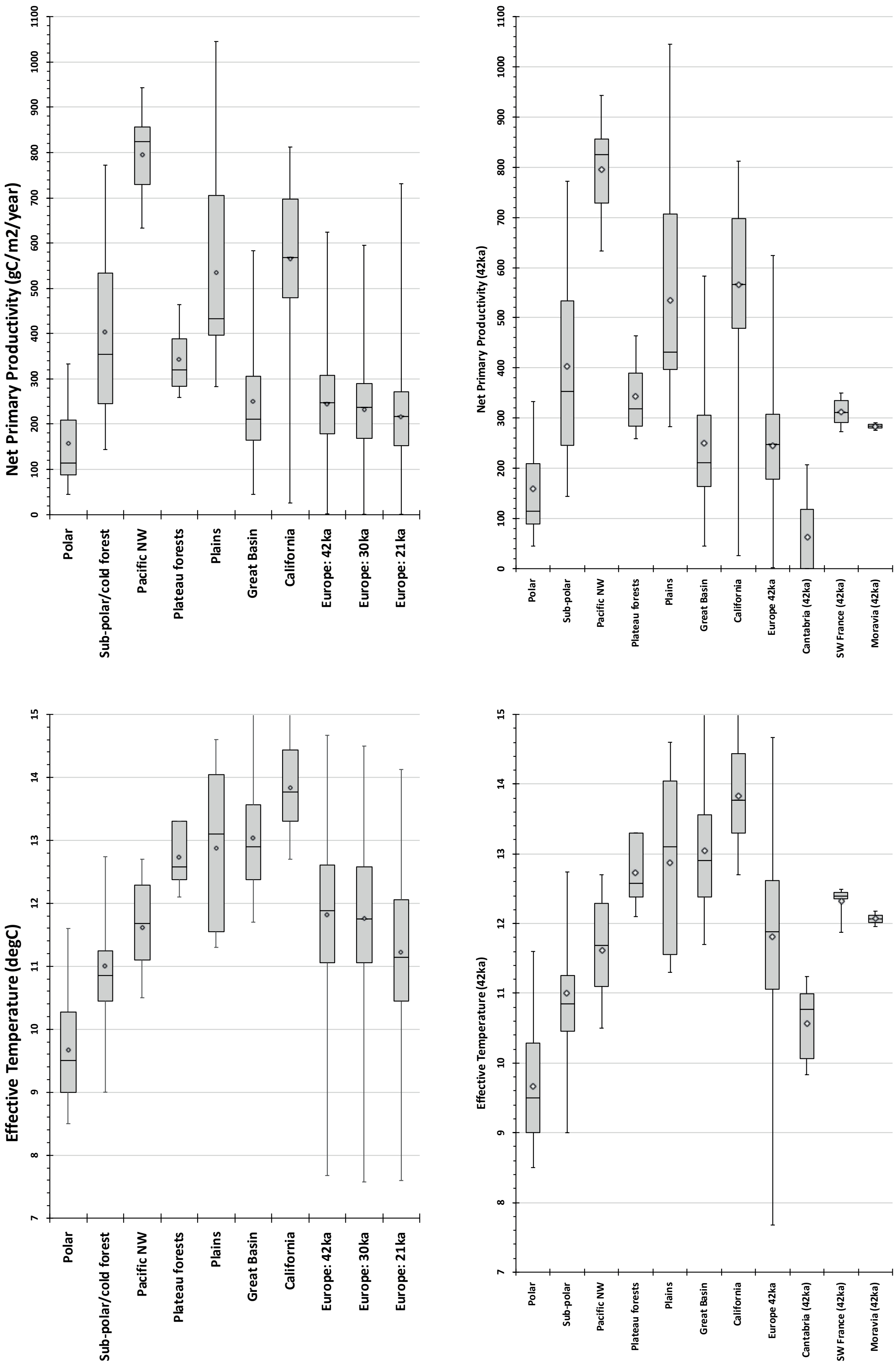


Figure 9.2 *(cont. opposite). Spatio-temporal distributions of NPP and ET in Upper Palaeolithic Europe, and by region/site: Cantabria, southwest France, Moravia, and two key isolated sites (Paviland and Sunghir). Mean values denoted by white diamonds.*

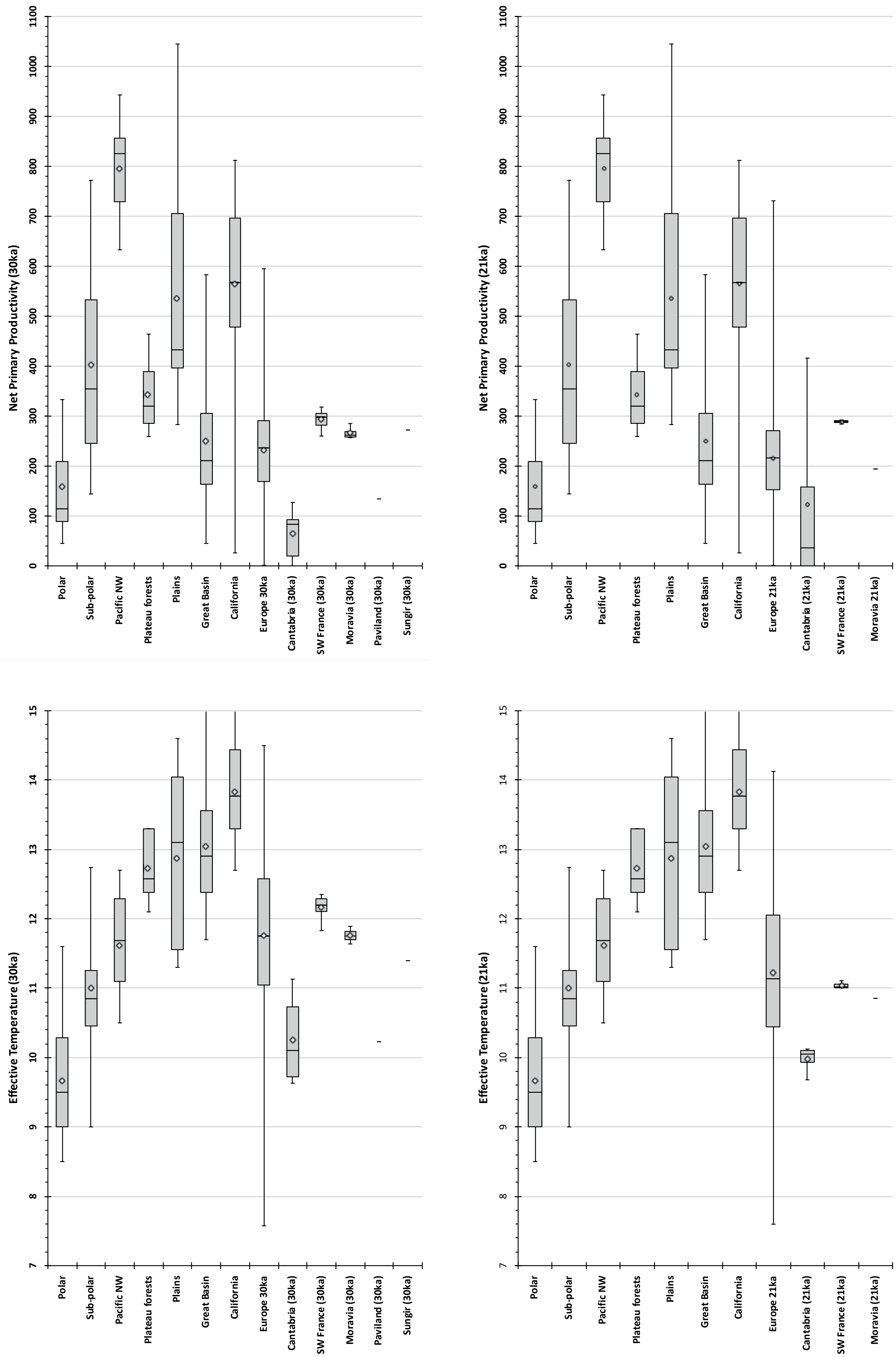


Figure 9.2 *(cont.)*.

21 ka: 10–12 months; Paviland, 30 ka: 6 months), temperatures above 10°C (42 ka: 2 months; 30 ka: 1–2 months; 21 ka: 0–1 months) are rather less common, unlike the situation seen in southwest France, Moravia and at Sunghir (Fig. 9.3). With NPP values generally lying below 320 g carbon per sq. m per year for the key European Upper Palaeolithic regions/sites (Figs. 9.1, 9.2; Appendix B), rather than the Pacific Northwest Coast's range of 633–943 g carbon per sq. m per year, it is hard to see how the latter could be seen as an analogue of resource richness for the former. Instead, Upper Palaeolithic Europe's productivities seem to have been much lower: more akin to those from current Great Basin environments, as well as those from Polar, Sub-polar and Plateau biomes (Fig. 9.2). More recent NPP estimates by Allen et al. (2010) and Huntley et al. (2013) have done little to alter our preceptions of relatively low productivity European Upper Palaeolithic environments.

Different methods of estimating NPP privilege different aspects of plant growth: not just growing temperatures, precipitation and potential evapotranspiration (e.g. Kelly 2013; Tallavaara et al. 2015), but also (in some models) carbon dioxide concentrations and forest canopy structure (Huntley & Allen 2003; Allen et al. 2010; Huntley et al. 2013). These simulations thus need testing against other lines of evidence. Dated plant macrofossils can yield useful productivity data if well-enough preserved. Analyses of growth rings in carbonized wood from Upper Palaeolithic sites corroborate low productivities in the late Pleistocene: the Gravettian sites of Pavlov, Dolní Věstonice and Krems-Wachtberg show clear growth-ring evidence for slow-growing, dense wood in the environs of these sites, and also implying delayed springs, cool summers and early, cold, autumns (Beresford-Jones et al. 2011; Pryor et al. 2016; Opravil 1994; Damblon 1997; Cichocki 2000; Cichocki et al. 2014). Slowly growing trees and shrubs would have affected the productivity of firewood, raising the key question of how long high-latitude groups could remain in an area before fuel became exhausted, enforcing displacement of people for decades until the supply was replenished (Pryor et al. 2016). The shortage of fuel would not only affect the ability to provide heat (for warmth, cooking and manufacturing) and light, but also for smoking

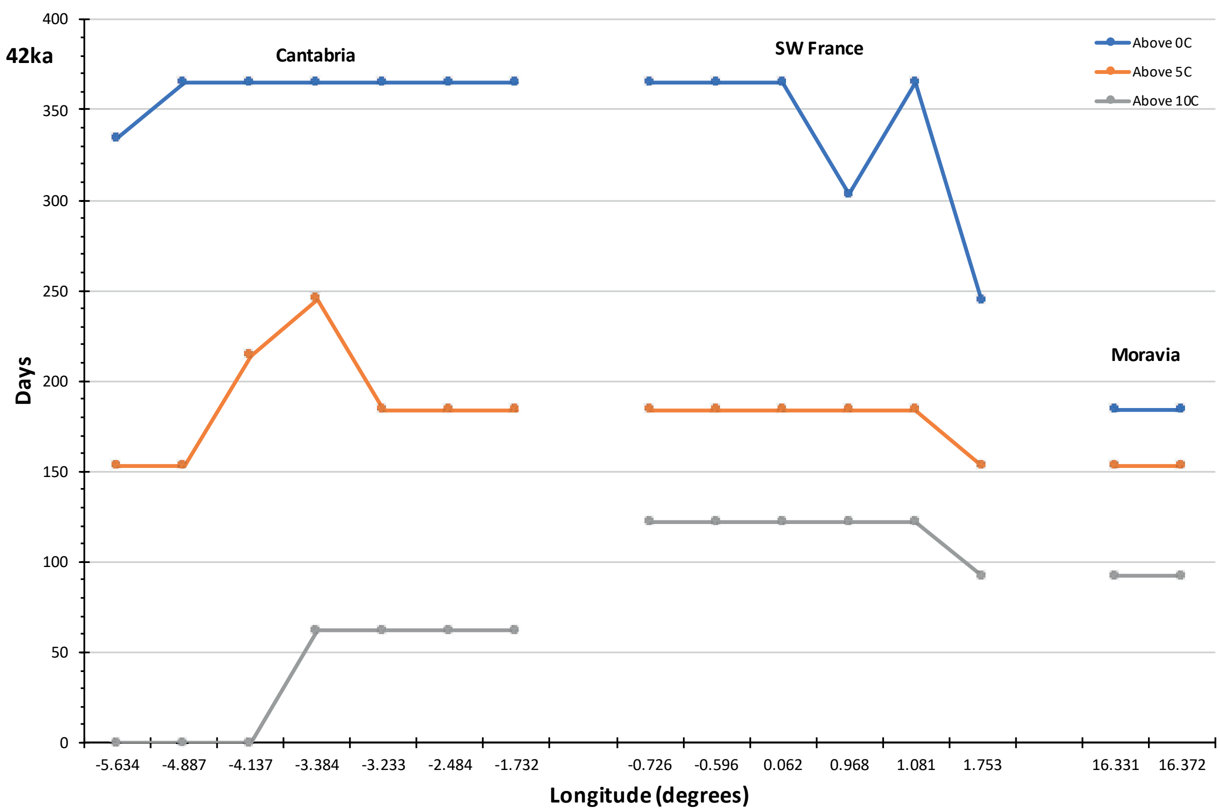
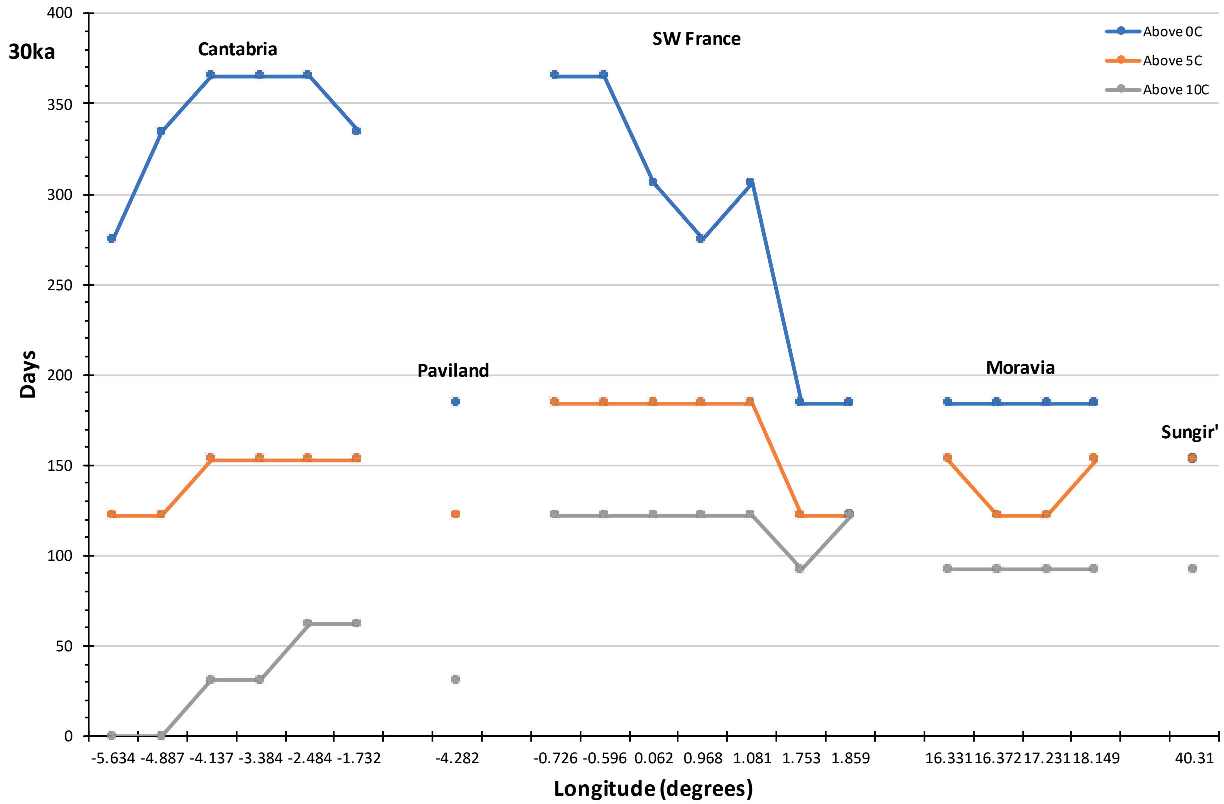
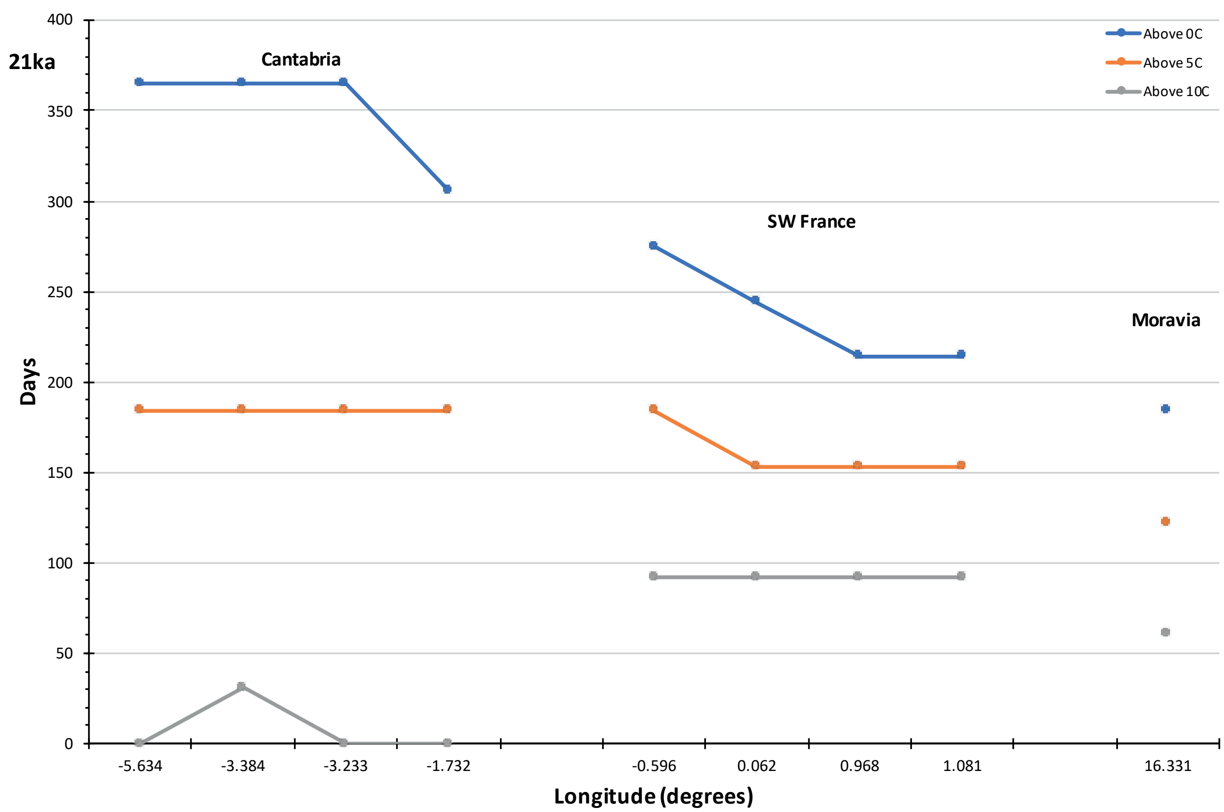


Figure 9.3 *(opposite and above). Number of days per year with (growing) temperatures above 0°C (blue), 5°C (orange) and 10°C (grey) at 42 ka, 30 ka and 21 ka.*


30ka
Cantabria
SW France
Paviland
Moravia
Sungir'
Above 0C
Above 5C
Above 10C
Days
Longitude (degrees)
-5.634 -4.887 -4.137 -3.384 -2.484 -1.732
-4.282
-0.726 -0.596 0.062 0.968 1.081 1.753 1.859
16.331 16.372 17.231 18.149
40.31


21ka
Cantabria
SW France
Moravia
Above 0C
Above 5C
Above 10C
Days
Longitude (degrees)
-5.634 -3.384 -3.233 -1.732
-0.596 0.062 0.968 1.081
16.331

surplus meat for storage. Slow growth also would affect the suitability of locally available wood for production of wooden tools (e.g. projectile shafts: see p. 150). The structure of *c.* 8–10 cm thick spruce logs over the Dolní Věstonice Triple Burial (Trinkaus et al. 2006: 16) presumably required wood of suitable dimensions, rather than of a particular structural quality.

Glacial aridity and – by extension – clear skies have been seen as a driving force of Guthrie's 'Mammoth steppe' (Guthrie 1982, 2001; Guthrie & van Kolfschoten 2000), creating large areas of mid-latitudinal steppic (mostly herbaceous) vegetation that supported megafauna such as mammoth, woolly rhinoceros, reindeer, musk ox, saiga antelope, cave lion, wolf and fox, in non-analogue combination with horse, red deer, hyaena and aurochs. The rapid Dansgaard-Oeschger climatic cycles would help to create changing environmental compositions and productivities in a given location, and these fluctuations operated at much larger spatio-temporal scales (and with much more unpredictability) than those acknowledged in Owens & Hayden (1997: 123). This unpredictability would have made it difficult for structured socio-economic complexity to arise in much of the Upper Palaeolithic (next section). Soil micromorphological studies of the 2005 excavations at Dolní Věstonice II, and at the contemporaneous site of Předmostí, have indicated that the Gravettian occupation was on the surface of an incipient soil (with evidence of grassland vegetation and some (coniferous) trees): periodically saturated, but otherwise showing evidence of low soil moisture (Beresford-Jones et al. 2011; Paine 2012). The small quantities of micro-debitage at Dolní Věstonice II (2005 excavations) might indicate ephemeral occupation, and the agglomerated, deep series of hearth deposits suggests use, interspersed with 'significant periods of disuse' (Beresford-Jones et al. 2011, 1959) when loess covered the hearth. This sequence of use and disuse might have lasted some six centuries (Beresford-Jones et al. 2011, 1954). It could be that the disuse reflected relocation to another part of the Pavlovské Hills where preferred conditions arose or survived, but overall, the association of many Moravian and Austrian Gravettian sites with periods of soil formation is intriguing (Paine 2012): where did human groups go when conditions deteriorated, preferred plants and animals were displaced, and aeolian sediments began to accumulate? Occupation at Dolní Věstonice II might cover a single Dansgaard-Oescheger event, perhaps situated in the GS-5b oscillation in NGRIP (*c.* 32.04–30.84 ka) (Beresford-Jones 2011, 1962; Rasmussen et al. 2014). Such apparent lack of stability in regions with highly developed Upper Palaeolithic material culture would surely have ensured that only relatively ephemeral socio-economic inequalities might develop.

Issues of seasonal availability and quantities of resources are beginning to be more clearly articulated, although our knowledge of environmental productivities is in its infancy: NPP simulations need greater detail and testing against environmental proxies (including tree growth rates) from archaeological sites or their environs. It is currently difficult to estimate aquatic productivities, so our picture of *total* primary productivity (including underground storage organs from aquatic plants and marine algae) for the European Upper Palaeolithic is by no means complete. Archaeological evidence of marine and freshwater resources exists, e.g. in Cantabria and Moravia (Freeman 1981; Pryor et al. 2013), though a more holistic environmental productivity model (incorporating both aquatic and terrestrial biomes) would enable us to assess the extent to which aquatic resources might have been used to mitigate lower terrestrial productivities. Evidence for exploitation of marine algae has been inferred from molluscan evidence at just two late Upper Palaeolithic Iberian sites: Parpalló (Solutrean) has six *Neritina* sp. shells, claimed by Freeman (1981: 151) to be too small to be food, though they could have served as potential beads/pendants), while Santa Catalina has *Rissoa parva* (Final Magdalenian: level II) and *Bittium reticulatum* (Azilian: level I) shells (Berganza et al. 2012: 178–9). It is unclear whether seaweed was used for packing marine fauna to maintain freshness, and/or as food.

To return to the quotation near the start of this section, rather than 'unequalled richness,' the evidence instead suggests intermittent resource bounties. Climatic and environmental fluctuations might have permitted the intermittent occurrence of individuals with competitive and aggrandizing tendencies (Hayden's (1995, 1998) 'despots': Table 9.1). The problem of equifinality makes it difficult to see any evidence of Upper Palaeolithic storage as indicating long-lasting, structural inequalities: the general indications of variable, and often depressed, productivities in the late Pleistocene, together with the nature of the available resources, suggest that storage was practised to mitigate fluctuations in supply (household self-sufficiency). It is therefore hard to see how other community members could be persuaded to surrender control over any temporary surpluses they might have accumulated; certainly, clear surpluses could not be continually accumulated over lifetimes (unless more durable materials were selected: see pp. 150, 153). The whole chain of inference (generation of surpluses that allow development of inter-individual/-familial competition and prestige, and then the formation of secret societies that control relationships of political, economic and supernatural support (Owens & Hayden 1997: 124)) thus lacks a firm foundation: resources are not demonstrably 'rich' and 'reliable.'

Upper Palaeolithic demography

Population estimates are generally relatively low for Upper Palaeolithic Europe, using a variety of proxy evidence (Appendix Table 9.C1). Maximal estimates generally lie below six figures for the whole of Europe, with late Magdalenian/final Pleistocene populations being the largest. When we consider population densities, recent modelling does not suggest any densities above Hayden's (2003) threshold of 10 persons per 100 sq. km (Table 9.2). Most reconstructed Upper Palaeolithic densities lie well below six people per 100 sq. km, which is below the modelled transitional threshold from band-organized societies to more tribal/chiefdom-based ones: 6.3–63.1 persons per 100 sq. km (Fig. 9.4; Newell & Constandse-Westermann 1986). Simulated population densities are higher for some regions and periods, but there is little to suggest more tribally or chiefdom-based societies in the Upper Palaeolithic. The nearest example to the latter is the Franco-Cantabrian Upper-Final Magdalenian, where multiple authors have modelled the densest Upper Palaeolithic populations in Europe: perhaps reaching maximal estimates of 17–20 persons per 100 sq. km (Appendix Table 9.C1), or third quartile values of 7.8 persons per 100 sq. km in southwest France (Kretschmer 2015). Similar densities were reported for two Inuit groups that specialized in aquatic and small game resources, with some reindeer exploitation (18–19 persons per 100 sq. km: Burch 1972: 350). Such densities suggest that social population units [bands] would have permeable boundaries, situated within bounded ethnic groups and exogamous breeding populations (cf. Sikora et al. 2017). The estimated low regional population densities and occupation areas (e.g. Maier & Zimmermann 2017) would have placed greater emphasis on the location of individuals within a territory in Newell and Constandse-Westermann's model, creating a system of overlapping mating networks. Densities scarcely attain those seen for Pacific Northwest Coast societies (mostly 10–96 persons per 100 sq. km: Kelly 2013, Appendix Table 9.C1). As discussed earlier, we have little evidence, even in Franco-Cantabria, for consistent production of surpluses that would sustain transegalitarian societies and the subordination of bands to tribal/chiefdom social structures.

The Upper Palaeolithic evidence for broad-spectrum consumption has demographic implications. While there is no clear evidence of predominant exploitation of small fauna and plants, their presence is consistent enough to suggest they were a significant economic resource for some groups. The restricted mobility of such resources might imply sedentary or semisedentary human economies, allowing persistence in a location and the practice of activities that required reduced mobility. However, evidence for population packing in the regions with clear evidence of broad-spectrum economies is unclear. Demographic estimates for Upper Palaeolithic populations are missing for much of the Mediterranean region, but those for southern Iberia, southern France and parts of Italy are relatively low (Kretschmer 2015; Maier et al. 2016). Exploitation of a wide range of food resources may have been needed simply to support groups in relatively arid environments, where large herbivores were also rarer than on the mammoth steppe. Even in that habitat, sites such as Pavlov and Dolní Věstonice do not show clear evidence of long-term occupation, despite the range of species exploited (Wojtal et al. 2012, 2018). It is possible that long-term intensification at the latter sites was limited by local environmental instability (Paine 2012) and restricted productivity of key resources like firewood (Beresford-Jones et al. 2011; Pryor et al. 2016). Thus, there might have been transient 'big men' (Cashdan 1980) or despots (Table 9.1) at these sites, but nothing more structurally inegalitarian.

Archaeological evidence for group sizes at Upper Palaeolithic sites is limited. Many estimates depend on the sizes of features and assemblages (artefactual and faunal) at sites, which may have been contingent on local spatio-temporal resource availability (Appendix C). The Middle Magdalenian at Maszycka (Poland) has yielded what is argued to be a catastrophic death assemblage for a household (several related families?), thus providing a rare indication of group size and composition. However, even this assemblage cannot be seen as a direct reflection of group demography, as the bone fragments are highly modified and were probably selectively deposited. Their fragmentary condition has made it difficult to calculate the number of cave occupants: initial estimates of at least 16 individuals (one male and seven indeterminate infants, three female juveniles, three female and two male adults) (Kapica & Wierciński 1993) have since been revised as a minimum of nine individuals (four adults (one sexed as male); five children) (Orscheidt et al. 2017). Empirical evidence of Upper Palaeolithic site demography (size and organization) is thus rare and variable, making it difficult to relate directly to resource consumption.

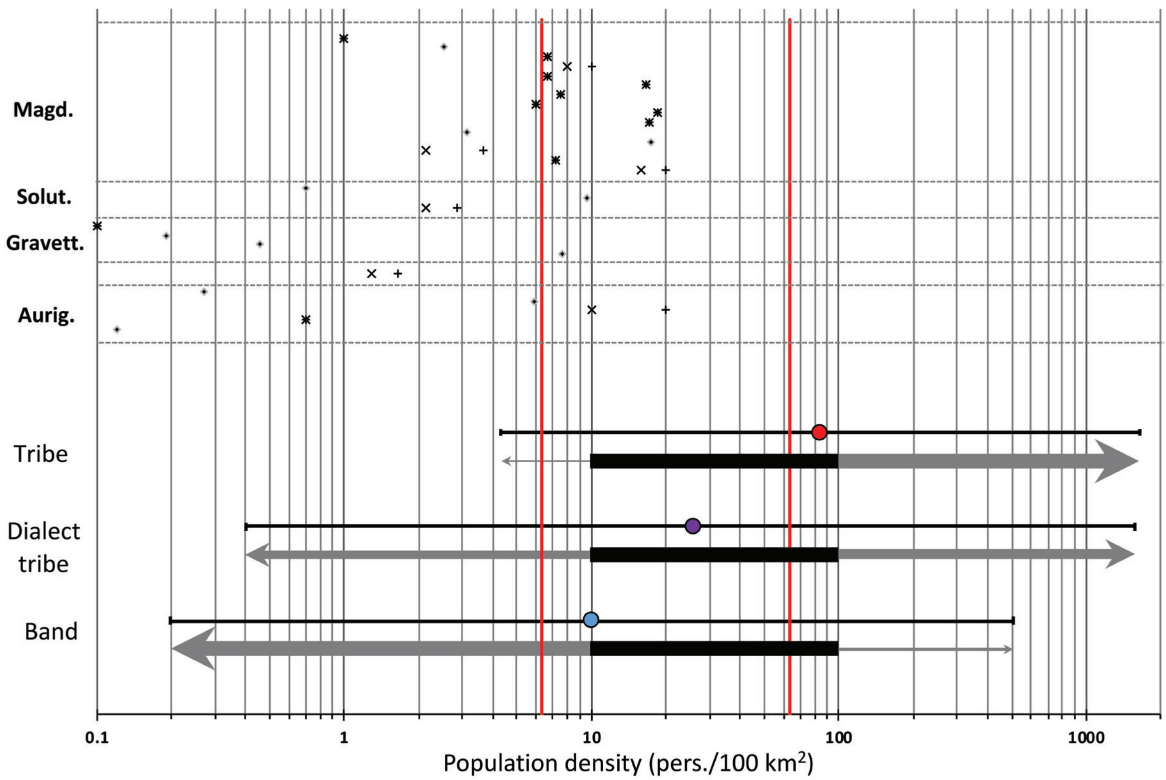
Mobility and motility have been recognized as key aspects of Palaeolithic demography for several decades (Dyson-Hudson & Smith 1978). Motility is the '*the capacity or potential to be mobile*' (Weig 2015, 423), setting the choices and limitations that precede movement into a temporal dimension. Zubrow's (2010) equality of opportunity (Table 9.1) can be used to evaluate intragroup motility options and constraints: was motility connected to age, sex and social ties, with resulting differences in potentials for interaction and transfer of knowledge (Weig 2015: 428)?

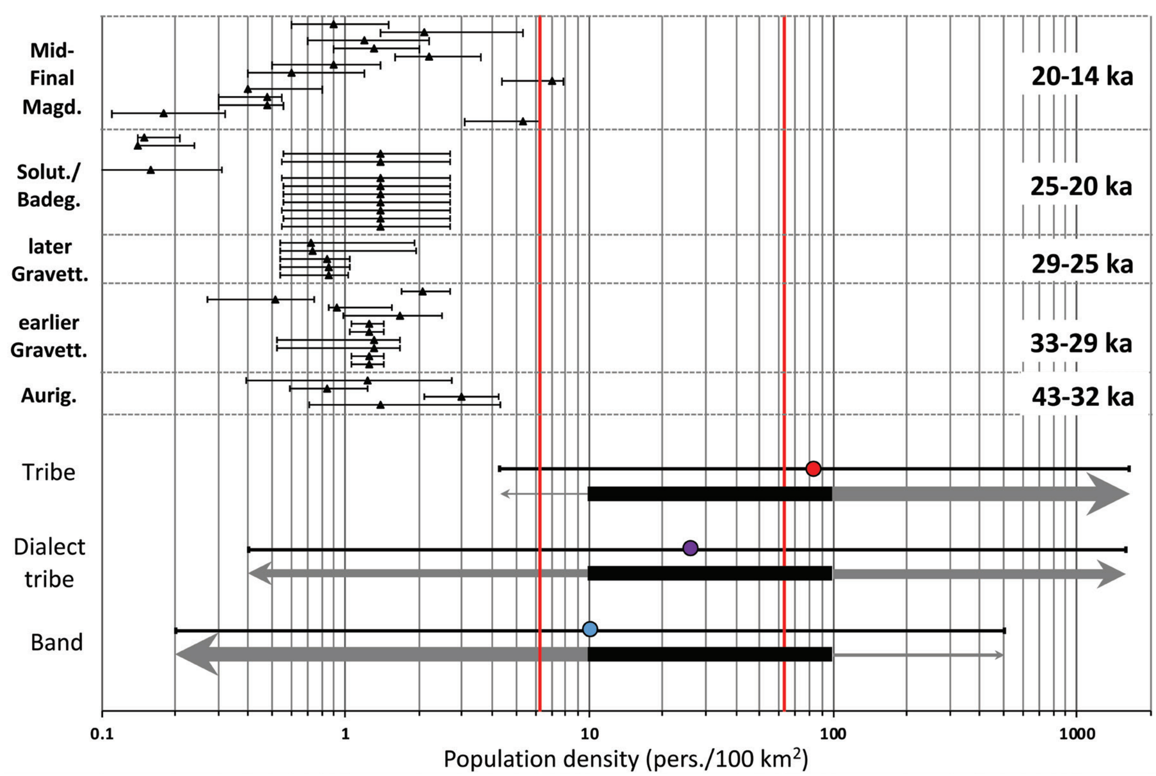
Aggregation to exploit high-density (and predictable) resources would be one example of motility, and another would be constraints on group fission, e.g. population 'packing,' topographic barriers or warfare, that might restrict options for movement (Hayden 2008: 22; Boone 1992). Most European Upper Palaeolithic contexts were in areas with not particularly abundant or predictable resources. Options A, B and D (Fig. 9.5) are therefore more likely than geographically stable territorial systems with resource contests. 'Contests' are a form of resource competition where available patches are restricted by prior occupancy or despotic control; pairwise competitions between individuals over particular resource patches result in success or failure in winning or holding a patch (Boone 1992: 315–16). Individuals' fitness thus correlates with unequal patch qualities (and differential access to them); the fitness of those holding desirable territories is not necessarily lowered by the addition of other people. Social hierarchy can therefore develop around resources that are defendable and divisible, if the costs of defence can be maintained. The alternative competitive strategy for resources (Boone 1992) is the scramble: all individuals are equally empowered and informed to choose the best-available resource patch or strategy, but in sparse and unpredictable patches that are not economically defensible, every additional participant lowers the fitness of other group members. There is little evidence of resources that were predictable or dense enough to be defendable or divisible, and thus there is no clear socio-economic development throughout the European Upper Palaeolithic. Potential examples of resource division do exist, but not on a scale where we can generalize for a whole region or technocomplex: a wide variety of habitat sizes and structures can be found within each major Upper Palaeolithic technocomplex.

Environmental fluctuations during the Upper Palaeolithic would have affected economies (resource abundance, distributions and predictability; technology) demography (population sizes, densities and mobilities) and knowledge exchange (density and structure of networks). Fluctuations and changes are seen in all the major Upper Palaeolithic technocomplexes (Davies 2001; Maier & Zimmermann 2017; Maier et al. 2016; Appendix Table 9.C3). Technological change may be more indicative of motility and mobility than increasing intensification and surplus-production (Appendix Table 9.C2). Habitat-tracking (targeting particular biomes) underpins both human demic dispersal and contraction/refugiation. Dispersal processes operated at multiple spatio-temporal scales, not just happening at the start of the Upper Palaeolithic and the Lateglacial; likewise, contraction/refugiation processes were not restricted to the LGM. Late Pleistocene spatio-temporal shifts in the mosaic of biomes and resource attractors created corresponding shifting potentials for motility in Upper Palaeolithic societies. The durability and nature of any resource 'hot-spots' would determine whether they would generate contests rather than scrambles. High-density networks would be more resilient to environmental perturbations, as they have a high capacity for information transmission, unlike low-density ones with few connections or ones with a few highly connected hubs (Fitzhugh et al. 2011).

Information exchange is key to adaptations in areas with scarce and often unpredictable resources (Fig. 9.5). It operates at two main social and spatial scales (local/inter-band; supra-/multi-band), tracking environmental productivities and changes with different levels of adaptive depth (Fitzhugh et al. 2011: 91). Mobility

Figure 9.4 *(opposite). Reconstructed population densities compared against the modelled transition (6.3–63.1 persons per 100 sq. km: between the two vertical red lines) from band-organized societies to tribal/chiefdom-organized ones (Newell & Constandse-Westermann 1986). Means for the three social groupings are shown with $\log^{10}$ double standard deviations (95 per cent confidence): band-level societies (mean: 10.1 persons per 100 sq. km; range: 0.2–504.3 persons per 100 sq. km at two standard deviations; N=93), dialect tribes (mean: 26.1; range: 0.4–1586.3 persons per 100 sq. km; N=169), and tribal/chiefdom-level (mean: 83.9 persons per 100 sq. km; range: 4.3–1646.0 persons per 100 sq. km at two standard deviations; N=76). Thickness of grey and black lines beneath each mean reflects the relative proportion of groups in that category (<9.9 (grey), 9.9->99.1 (grey) and 99.1 (black) persons per 100 sq. km). (a) Aurignacian, Gravettian, Solutrean and Magdalenian population estimates: means (◆) (Bocquet-Appel & Demars 2000); minimal (×) and maximal (+) estimates (Hahn 1977; Straus 1986; Biraben 1988; Zimmermann 1996; Rozoy 1996, 2001). (The Hahn (1977) estimate of 10–20 persons per 100 sq. km for the Central European Aurignacian is uncertain, as it is based on very few, widespread, sites.) (b) Earlier and later Gravettian, Solutrean/Badegoulian, and Middle-Final Magdalenian median (▲) and interquartile ranges for key occupied areas in Europe (from Kretschmer 2015; Maier et al. 2016; Maier & Zimmermann 2017).*


Magd.
Solut.
Gravett.
Aurig.
Tribe
Dialect tribe
Band
0.1
1
10
100
1000
Population density (pers./100 km²)


Mid-Final Magd.
Solut./ Badeg.
later Gravett.
earlier Gravett.
Aurig.
20-14 ka
25-20 ka
29-25 ka
33-29 ka
43-32 ka
Tribe
Dialect tribe
Band
0.1
1
10
100
1000
Population density (pers./100 km²)

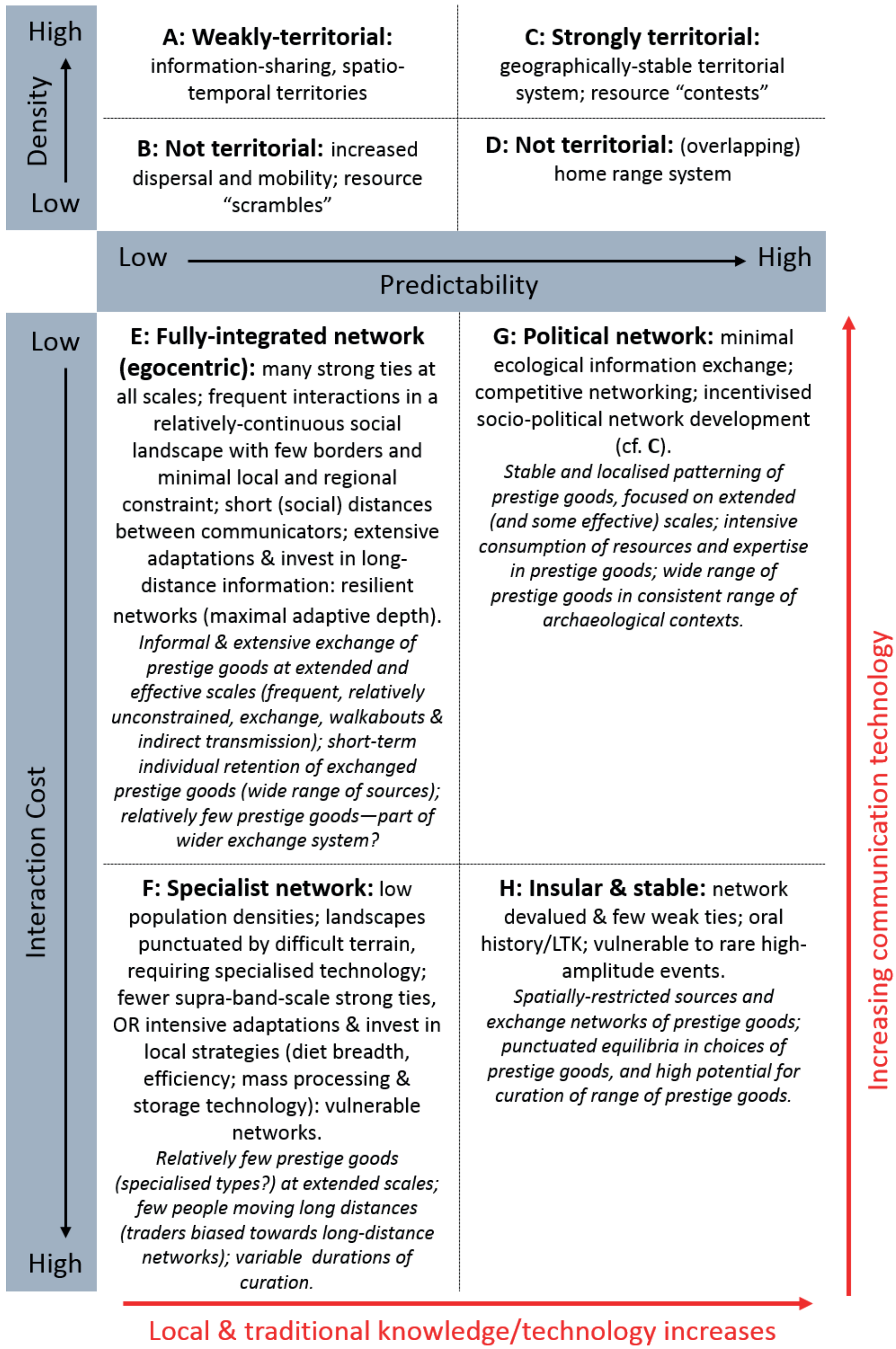


Figure 9.5. *The effects of resource predictability and abundance on territorial organization and exchange networks (after Dyson-Hudson & Smith 1978; Boone 1992; Marean 2015; Fitzhugh et al. 2011). The y-axes of both grids are different, which ensures that they do not directly map onto each other; resource productivity is taken to be sufficient to support population density, and therefore omitted by Fitzhugh et al. (2011). 'LTK' = Local and Traditional Knowledge. Categories E–F are all assumed by Fitzhugh et al. (2011: 97) to be founded on sufficient environmental productivity for the local population density. 'Effective' and 'extended' scales taken from Gamble (1999: 50–3). E–H: hypothetical prestige exchange patterns in italics.*

Table 9.3. *Information transmission types (Fitzhugh et al. 2011) compared to demographic (including longevity of units) and spatial attributes from forager societies (Newell & Constandse-Westermann 1986; Wobst 1974). ('Half-life' reflects longevity and relative stability of social units in equilibrium conditions, and gives a* minimal *indication of the time taken for half the original existing units to become extinct, e.g. half of families survive a single generation (Wobst 1974).)*

Social Unit	Population			Spatial extent (sq. km)			Duration (yrs) ('half-life')	Information transmission type
	N	Mean	Range (2 SD)	*N*	Mean	Range (2 SD)		
Language family	*23*	4514.09	165.2–124,165.23	*23*	18,801.82	537.03–657,657.84	2000–8000	Oral history (millennial scale). Inter-regional (>320 km) & regional (160–320 km) networks
Tribe/Chiefdom	*193*	897.18	112.7–7142.0	*215*	3303.62	46.78–233,287.79	691-716	Local & traditional knowledge (centennial scale). 'Supra-band' (64–160 km) & local band (<64 km) networks
Dialect tribe								
Band	*113*	297.21	43.76–2018.53	*69*	1926.95	19.45–190,883.33	>180	
Household/ family							*c.* 25	Partnerships (decadal), e.g. hxaro networks & task groups, and local adaptive mechanisms (annual/sub-annual scales)
Individual							30–34	

facilitates multi-scalar transmission of information, from highly detailed local knowledge (containing redundant information collected during everyday activities), more cursory and infrequent regional information exchange (loss of detail between bands over distance: susceptible to down-the-line bias), and inter-regional exchanges between minimal bands (supra-band aggregations, informal long-distance travel/'walkabouts,' inter-individual partnerships and marriage-alliances) (Fitzhugh et al. 2011: 91). If the network is fully integrated over varying social and spatial scales, lower-amplitude, often frequent, shifts in resource attributes (productivity, diversity and distribution) can be closely monitored. Larger-amplitude fluctuations require more extensive information networks or greater mobility if groups are to survive, to mitigate the effects of any deterioration. Informal regional networks (Fig. 9.5: E) are resilient to environmental change, having a greater range of adaptations at different scales ('maximum adaptive depth' (Fitzhugh et al. 2011: 96)) and frequent, unconstrained, local and regional interactions. They are further characterized by 'a relatively continuous social landscape, with few social or physical barriers' and short interaction distances (Fitzhugh et al. 2011: 96). Fluidity of group membership, via fission-fusion processes, could reduce the costs of information transmission over longer distances (Table 9.3, Fig. 9.5), though the range of material culture transmitted at the supra-band scale is more restricted (Gamble 1999: 49–63).

The social construction of resources in the Upper Palaeolithic

As stated at the start of this paper, 'resources' are not self-evident entities. They include not only food, but also those needed to make artefacts and fuel heat and light; people, in the form of labour and expertise, can also be seen as resources. Selection of particular resources, the manufacture of artificial materials, and the social value placed on them (as reflected in procurement, transport, processing and storage) will all be examined in this section. We shall consider the extent to which activities and processing of resources can affect motility, and the potentials for secrecy in the use of materials or the control of know-how. If the resource patterning discussed so far provides no clear support for structural inegalitarianism in Upper Palaeolithic societies, can we identify inequalities in resource usage?

The extent to which dedicated specialists were required in the sourcing and processing of technical resources in the Upper Palaeolithic is unclear: we have no *unambiguous* archaeological evidence to suggest secret workplaces or controlled access to technical knowledge. Reconstructed Upper Palaeolithic group sizes suggest that what might have been small activity areas (e.g. the rear of Hohlenstein-Stadel cave, Germany (Aurignacian) (Kind et al. 2014)) could in fact have contained the whole group, not just a fraction of it. That is not to state that all Upper Palaeolithic people were equally talented or experienced in every technical skill, but archaeologically it is difficult to distinguish equality of opportunity in acquiring skill from more hierarchical control of knowledge and expertise by specialist craftspeople (Table 9.1). Human skeletal remains can show evidence of persistent behaviours, e.g. heavy manual labour, repetitive manual actions, but are difficult to link to *specific* activities and tool-types, and so cannot be used to demonstrate inequality in the technical sphere. However, *artificial* materials (e.g. composite pigments, mastics, ceramic) have greater *potential* for specialist, secret (or *ad hominem*) knowledge than those that are common and require relatively straightforward processing (e.g. stone, bone). Some natural materials, such as antler, ivory and wood, may have been commoner and more accessible in some parts of Europe than elsewhere, leading to variation in potentials for unequal access within technocomplexes: in areas where they were scarce or unknown, exchange or long-distance procurement would be needed to provide them, with better-connected individuals benefiting more than others.

Intra-site spatio-temporal patterning of resources and associated technologies has potential for evaluating Upper Palaeolithic inequalities, e.g. the combination of comminuted and heat-altered resources into specific artificial compounds (pigments, mastics, ceramics, and even some foods). Concealment of such materials or the knowledge of their ingredient proportions and processing (Table 9.2) needs to be demonstrated case-by-case, and is not exclusively diagnostic of structural inegalitarianism. We should not rely on similarities of form, when the resource ingredients, *technological* styles and archaeological associations can be much more varied. Generalized traditional analyses of Upper Palaeolithic art, focusing on similarities of form, have begun to be tested by studies of the varying *chaînes opératoires* used to produce the pigments (e.g. Leroi-Gourhan 1982; Lorblanchet et al. 1990; Clottes et al. 1990). Today's egalitarian forager societies display inequalities of knowledge, particularly relating to craft-specialization and ritual involvement (Woodburn 2005: 26). Clottes et al. (1990) emphasize differences in pigment 'recipes' between Magdalenian sites; the same images were even painted with different 'paint pots' (varying pigment recipes and sources of constituent ingredients). Were such differences the results of different artists and their individual preferences, or of artists of different status (or place of origin)? Other artificial materials display similar heterogeneity: ceramic figurines from the earlier Gravettian (Pavlovian) sites of Dolní Věstonice and Pavlov show different ways of shaping the form and surface features, varying between site locales, and also within the same artefact type (Farbstein & Davies 2017). It has also become apparent that Pavlovian knapped stone assemblages were heterogeneous at the same sites (Polanská & Novák 2014), implying household-based or diachronic variations in lithic and ceramic *chaînes opératoires* for assemblages that have tended to be seen in monolithic terms.

The fluctuating population histories of many Upper Palaeolithic regions of Europe probably ensured loss and reinvention of technical knowledge and use of raw material sources over time and space. Clottes et al. (1990) identified significant chronological gaps in image production at Niaux, based on pigment recipe variation, while Lorblanchet et al. (1990, 7) argued for similar gaps in production (millennia) in Cougnac. This irregularity would appear to support a model of ritual knowledge inequality that was individualized, rather than structural and consistent. Such resource use was thus not transegalitarian, but consistent with the variation seen in generally egalitarian extant foragers. If production of pigments and art were part of transegalitarian status and regular initiation ceremonies, would we not expect more consistent 'recipes' for pigment production?

Natural distributions of resources were not homogeneous across Upper Palaeolithic Europe, affecting the ability to deliver equality or opportunity or outcome (Table 9.1) at anything greater than the local scale. Technological options to maximize available resources, and social ones to obtain suitable materials from elsewhere, were evident in the Upper Palaeolithic from its inception, allowing people to mitigate fluctuations in supply to some extent. In regions where such materials might be in short supply, e.g. wood suitable for artefact manufacture in higher latitudes, technology would have to focus on maximizing the productivity and conservation of scarce resources. Compositing suitable sections of scarce material (e.g. slow-growing, dense, locally available wood), or protecting them with commoner resources (stone/antler projectile tips), might have helped to prolong the lifespans of tools, e.g. the Ahrensburgian pine arrowshafts of Stellmoor (Price et al. 2017: 213; Bokelmann 1991: 79).

The ability to create artificial resources, often from materials not reliant on biological productivity, seems to have been relatively spatio-temporally restricted: ceramic and pigment production was intermittent, and highly localized. It is premature to say whether such materials were exchanged, or whether they were restricted to households or certain members of the group. During manufacture, artificial (plastic) resources would have constrained motility, requiring episodes of intensive time-budgeting, unlike more durable materials (bone/antler/ivory, stone) that could be carried round the landscape while being worked. Proximity to fire would have governed production of ceramics, mastics, etc., and ceramics could not be moved even short distances before they were dry enough (Farbstein & Davies 2017). This variation in temporality of different resource types would surely have affected household motility, unless people were prepared to abandon such objects between production stages.

Many resources are socially constructed; there are no *a priori* reasons why they should be needed, rather than desired, by people. In extant acephalous foraging societies, there is little structured control of individuals' actions. Children are guided towards self-reliance, rather than their labour being controlled through lineages (Woodburn 1982), and leaders have no redistributive roles or formal political power (Cashdan 1980: 119; Appendix A). Freedom to associate with (or dissociate from) others affects what people learn to do, and from whom. Knowledge and labour are therefore not strictly controlled by any individual, though there is potential for some practitioners to be more influential than others, and ritual activities are still generally more controlled (corporate, not individualized) than other spheres of activity. In this context, we might interpret the finger-prints of mostly immature individuals on Pavlovian ceramics as part of juvenile involvement with ceramic production (Králík et al. 2002; Králík & Einwögerer 2010).

Hayden's 'despots' seem founded more on warfare and production (Table 9.1) than ritual; while control of the latter is seen in all extant hunter-gatherers, initiation into such activities is not restricted in many groups, except by sex (Appendix A). Hayden (1998: 12) has argued for the transformation of food surpluses and labour into less-perishable wealth, such as the accumulation of exotic resources or prestige goods. The drive to accumulate such prestige would lead to competition to attract the (best) craftspeople to produce such wealth (Hayden 1998: 17). As we have already seen, population levels and environmental productivity were not elevated enough to restrict people's motility, making it hard to control them. Indeed, the best craftspeople – if we can demonstrate the existence of despots in some parts of the Upper Palaeolithic – would surely have had greater negotiating power if their skills were in demand. They could thus range widely, and move between groups, on the strength of their skills. The potential for identifying the movement of such expert practitioners is constrained by preservation/recovery and by our confidence in identifying the 'hand' of such people in the archaeological record (artworks, specialist knapping, etc.).

At present, there is little Upper Palaeolithic evidence for the production of consistent surpluses that would sustain an elite; instead groups might have had intensive seasons of activity, when surpluses were processed and stored for subsequent periods of low environmental productivity. In such situations, the activities of specialists would vary over the course of the year, perhaps concentrated in periods when their participation in subsistence was not so important. Thus, equalities of outcome and/or opportunity would still be possible (Table 9.1), with every member being able to make individual contributions to the overall life of the group.

Who consumed which resources?

Resource use (including the sourcing, processing and sharing of materials) is one of the easier ways to track Upper Palaeolithic individuals' agency: how did it fit into household and broader economies? Late Magdalenian sites in northern France give some indication of resource movements round sites, and the potentials for inequality within living groups. Pincevent level IV-20 covers *c.* 4500 sq. m, and within it at least eleven hearths show refitting evidence for contemporaneity (David & Orliac 1994: 158; Enloe 2010a: 41). Assuming perhaps five people per group, David and Orliac estimated *c.* 55 people occupying the site for several weeks in autumn. Refitting of reindeer bones, and reconstruction of butchery patterns, clearly indicates sharing at the point of distribution among members of a socio-economically integrated community of households (Enloe & David 1989; Enloe 2010a,b). Meat-rich portions of single reindeer (upper forelimbs) were distributed over distances of up to 63 m (Enloe 2003), though marrow-/fat-rich distal limb elements seem not to have been shared, instead being restricted to what might have been successful hunters' households (Enloe 2003). The latter (hearths M89, V105, T112) are marked by rich flint and bone assemblages, and more variety of reindeer body parts (Enloe 2003). The asymmetric, but extensive, distribution of resources (donor-recipient or reciprocal sharing) might show strong potential for inequalities to develop, through control of what one household chooses to give another, or even deciding to stop sharing (Zubrow 2010). However, retention of some body parts does not necessarily prove inegalitarianism, and could instead be interpreted as akin to carcass division seen in immediate-return societies (Appendix A). Inegalitarianism would be easier to demonstrate if some households consistently received low meat-yield portions (phalanges, etc.) rather than the upper limbs documented by Enloe and David. The penecontemporaneous site of Verberie (level II.1) shows a different pattern of resource distribution, with primary butchery evidence (corporate processing?) being found at the site (Audouze & Enloe 1997). Sharing seems to have occurred at the point of consumption, but there is no evidence for Pincevent-like reciprocal sharing (Enloe 2010a). The site is much smaller than Pincevent, with the excavations covering some 400 sq. m, and it is possible that the site might have been occupied by one household (Audouze 2010). If there were more than one household at Verberie, there is no evidence of sharing between them. Faunal refits in this assemblage are much more restricted than those at Pincevent, with material moving an average maximal distance of *c.* 4 m (*c.* 20 m at Pincevent), and not shared between hearths (Enloe 2010a). The most securely refitting carcasses were found in a single large dump, between the two main hearths, implying a more communal consumption of food (Enloe 2010a), which might in turn imply some control within a single household over what people ate, and when. The strategies seen at Pincevent might indicate equality of opportunity (the down-the-line sharing of resources was too weakly discriminatory to be classed as structurally inegalitarian), while those at Verberie had more potential to promote equality of resources (if the site were occupied by a single household) (Table 9.1).

In theory, resource consumption would also have been affected by skill level: less-experienced or less-skilled practitioners would have been less efficient in resource use, with mistakes leading to discard of material (Pigeot 1990; Audouze & Cattin 2011). However, there are also clear examples of skilled individuals making artefacts more complex and complicated than necessary. Such objects would include Aurignacian split-based antler points and ivory musical pipes, and Solutrean leafpoints. It is difficult to know the extent to which these examples represent display or prestige items; all three were subsequently replaced/survived by simpler versions of the same artefact type (various simpler-based osseous points, bird-bone pipes and various unifacial knives and spear-tip forms), which might imply diachronic decreases in prestige, through lower time investment in manufacture and fewer 'redundant' features. Current archaeological evidence cannot falsify interpretations proposing a variety of skilled practitioners within essentially egalitarian societies: we cannot identify the exclusive actions of socio-economic specialists. Palaeolithic art varies greatly in quality, and we cannot demonstrate that the skilled knappers of Solutrean leafpoints were the same specialists producing elaborate osseous artefacts. Ceramics, wherever present in the Palaeolithic, are hard to define as 'exclusive' technology. The basic resources (wetted sediments) are hard to monopolize, and both Pavlovian and Epigravettian figurines seem to have been fired in domestic hearths (Farbstein & Davies 2017; Soffer et al. 1993). Economic support for non-subsistence activities might have been more flexible in Upper Palaeolithic groups than is often assumed (Hayden 2003: 131), with each group member having the opportunity to switch between subsistence provision and elaborate manufacture of non-subsistence goods over the course of a season or year, as determined by preference or ability. Skills could be (and probably were) distributed through the group, rather than in the control of a small sub-group, ensuring that devotion of 'surplus' time to non-subsistence activities might have moved around the group, rather than being held in the hands of a few specialists who delivered 'prestige.'

The role of 'prestige' goods in personal and corporate exchange networks also needs definition, and 'prestige' itself is variously characterized. Increasing distance from a source can transform the mundane into the exotic and prestigious (Gamble 1999: 95), as can expenditure of time and expertise in manufacture (including the sourcing of particular resources). Hayden's (2008: 85) definition is more functionalist, with prestige items being used to resolve problems, or to pursue socio-political goals. However, such problems and goals are difficult to define for the Upper Palaeolithic, so focus has tended to shift to 'ritual' contexts. Given that ritual, prestige, objects can be found in acephalous delayed-return societies (Woodburn 2005), e.g. Australian Aborigines, without requiring transegalitarian societies, their presence in Upper Palaeolithic contexts need not indicate transegalitarian organization (Layton 2005). Personalized prestige objects, perhaps used in ritual contexts, might include pendants and beads (especially perforated human and animal teeth), raptor bones, talons and feathers, and highly decorated 'utilitarian' objects (e.g. spear-throwers): all compatible with portability and mobile lifestyles (Henry-Gambier et al. 2004; Svoboda 2006; Laroulandie 2016; Álvarez-Fernández 2009). Small, portable artworks could have been personal objects (especially if adapted for wearing on the person), but alternatively their surface wear and polish could have arisen through more communal use. Shells, amber, lithic/mineral and osseous materials are easier to track than bone, antler and ivory, although ivory must have been imported into Gravettian northern Italy (Mussi 2000: 363). Very few show the distances (600–1000 km) described for the Pacific Northwest Coast (Hayden 2008: 92; cf. Féblot-Augustins 2009; Hussain & Floss 2016). The oolitic limestone used in the Willendorf 1 figurine seems to have come from Stránská skála, near Brno: a Euclidian distance of 136 km (Binsteiner et al. 2008). This transportation of resources contrasts with the earlier Gravettian (Pavlovian) ceramic Dolní Věstonice 1 figurine, found broken (by firing) in a large hearth in the 'upper settlement' of site I (Oliva 2005: 66; Soffer et al. 1993: 271). Such differentiation of mobility must have meant that prestige-through-distance would have varied within what we see today as an emic artefact class, and also has implications if we wish to see Gravettian female figurines as objects exchanged between groups to mitigate climatic challenges (Gamble 1982).

Network structure is key to reconstructing the social contexts of exchange and 'prestige' goods. The latter can be controlled and hidden more in closed societies with hierarchies, whereas exchanged resources/objects are more mobile (and ephemerally owned) in open-networked societies (Fig. 9.5). Resource exchange via down-the-line transmission, aggregations and personal networks would have worked differently in 'open' versus 'closed' social networks, yielding different opportunities for potential inequalities. If groups were small, and/or dispersing, open social networks would have ensured they were more successful in mitigating unpredictable or new environments (Fig. 9.5: E, and perhaps F): resources and knowledge would be distributed through personal networks, and periodically through aggregations and down-the-line transmission. More closed social systems would exert greater control over what was exchanged and by whom, with down-the-line transmission and personal networks being more restricted and hierarchical, and also competitive in the case of aggregations (Fig. 9.5: G, H).

The range of materials used in Upper Palaeolithic pendant manufacture varies from the local to exotic: ivory, chlorite, calcite, talc, haematite, lignite, amber, bone, animal and human teeth, marine and fossil shells for the Aurignacian alone (White 2007). Simple proximity to sources of resources does not explain the patterns we see in sites, implying that network connections must have structured resource use and exchange. The greater quantity of talc beads at Brassempouy than in the Castel-Merle sites might be explained by the former's greater proximity to the Pyrenees, yet Isturitz is even closer to those mountains, but has none. Instead, ivory was almost exclusively used at Isturitz, although amber is the only material at that site to yield a bead production *chaîne opératoire* (White 2007: 294–5). Aurignacian ivory beads at the Castel-Merle sites appear to have been manufactured in winter (White 2007: 296), presumably with the beads moving outwards along exchange networks, while marine shells from the Atlantic and Mediterranean coasts moved in opposite directions to Castel-Merle (Taborin 1993). Desirable (prestige?) items are revealed in what seem to be sculpted ivory marine shells in two Aurignacian sites (La Souquette; Spy) (Otte 1979: 304; White 1989: 378), while a Gravettian ivory pendant that mimics a fossil cowrie was found at Pair-non-Pair (Taborin 2000): were these pieces made for individuals that had no access to the real shells (envy and/or imitation)? If so, there was inequality of access to resources (Zubrow 2010) at these sites, but whether 'fake' shells amount to transegalitarianism is hard to demonstrate without demonstrable inequalities of access to other, currently unknown resources. Some materials, however, could not be reproduced or faked, and would need to be obtained directly or via exchange with areas that possessed them. Many are perishable, ensuring we cannot test their importance or sources in the Upper Palaeolithic record: wood suitable for making tools (e.g. spear handles), mastics and hides. Hide-processing is evident at sites such as Dolní Věstonice II and Pavlov I (Wojtal et al. 2012, 2018), but not in notably high quantities. If hides were exchanged for other resources, it does not seem to have been intensive, and thus we have to look elsewhere for evidence to support Upper Palaeolithic transegalitarianism. While our discussion of these materials must remain hypothetical at present, we should not forget that such materials were important, and that we cannot trace the movements of all materials important to Upper Palaeolithic groups.

Specialist objects may also inform us about Upper Palaeolithic inequalities. Such items (musical instruments, weapons, adornment, pigment mixtures, lamps used for accessing deep parts of caves) might have been privately owned, rather than being communal items. Musical instruments, in durable resources (bone, ivory: Conard et al. 2009) are intermittently found in the Upper Palaeolithic record, though it should be remembered that such objects were not essential for musicking, and anyway could have been made from more perishable materials (Lawson & d'Errico 2002). The idiosyncrasies of particular instruments might correspond to the manufacturing techniques of individual makers and/or the preferences of the player, if those were not the same people. The Aurignacian and Gravettian bird-bone pipes from Isturitz show consistent obliquity of the finger-holes in relation to the long axis, implying a formalized playing style (Lawson & d'Errico 2002): were such practices agreed by players, and if so, were such agreements informal or enforced? The latter does not prove transegalitarianism, as ritual standardization is also found in more egalitarian foragers. Playing an instrument is not intrinsically zero-sum, as it does not prevent involvement of others with the music, unless the space is too small or inaccessible to allow large group participation. In such contexts, the use of musical instruments in exclusive ritual behaviours might be argued, though most recovered instruments have been recovered from what appear to be generalized living spaces. Magdalenian bird-bone pipes from Isturitz appear to be less technically complex than the earlier Aurignacian-Gravettian ones (Lawson & d'Errico 2002), implying different requirements over time.

Apparent 'caches' of Upper Palaeolithic objects (Davies 2001; Peresani 2009; Verpoorte 2012; Steguweit 2015; Kilby 2019), would appear to be the actions of individuals or sub-groups provisioning the landscape for re-tooling when necessary (Binford 1979; Kuhn 1995). The alternative explanation (hunters carrying replacement osseous points on their person, and re-tooling when at rest at a site) does not explain why some Aurignacian sites have huge numbers of such points, while others have very few or none). Caching might have restricted access to such objects/materials at the intragroup scale: those that knew the locations of these caches would be able to utilize them, whereas others would not. However, such behaviour is not unique to inegalitarian societies, as many economically egalitarian hunter-gatherer societies today have hierarchies of knowledge (Table 9.1; Appendix A). Delayed-return strategies are thus suggested (though are hard to quantify) in Upper Palaeolithic provisioning strategies (Appendix A). Some Magdalenian sites suggest the provisioning of deep caves with lamps, sometimes in pairs; they seem to have been placed strategically in Lascaux (de Beaune 1987: 571–2). As with apparent caches of osseous points, not every cave art site yielded lamps (Rouffignac, Niaux, Les Trois Frères, etc.), implying the use of other light-sources, or the removal of lamps from deep caves after use (most were recovered from 'domestic' contexts) (de Beaune & White 1993: 112). It is hard to tell if lamps (each supplied with animal fat resources throughout their use-lives) were personal or communal objects, with interpretations largely based on archaeological context (special-activity/'ritual' vs. 'domestic') and levels of decoration (personalization?). Some highly decorated lamps have been interpreted as being used in special rituals, e.g. one found in the *Puits de Lascaux* (de Beaune 1987: 573).

Locales that can be controlled, owing to their size or accessibility, can make it easier to evaluate the level of restriction in the use of certain resources. However, such discussion relies on the deposition and leaving of resources in those places; if resources were carried out of the special activity areas, it is impossible to evaluate potential inequalities deriving from restricted resource use. The gallery above the Magdalenian camp at La Garma shows clear evidence of people moving along it, but relatively little material evidence of activity, apart from some painted signs (Arias 2009: 266–7). Other caves have more substantial evidence of specialized use of resources in deep galleries, e.g. placement of objects in fissures/cracks and on ledges, cave art, clay sculptures of animals, mostly, but not exclusively, from the Magdalenian (Arias 2009; Medina-Alcaide et al. 2018). The Hohlenstein-Stadel *Löwenmensch* (Aurignacian) is more typical of the earlier Upper Palaeolithic: an object positioned in a restricted part of a site, with very little other evidence of activity nearby (Kind et al. 2014), which may have been used by a whole group, or a smaller sub-group (initiates?).

Hayden (2003, 104) has emphasized the importance of initiation ceremonies, perhaps driven by starvation or predation, but of course such ceremonies are not unique to transegalitarian societies or restricted to certain lineages in current foragers (Appendix A). It is hard to evaluate evidence for initiation on extant Upper Palaeolithic human remains (incisions, tattoos, piercing, removal of body parts, etc.: Hayden 2003), but it may be possible to interpret the incised markings on Aurignacian figurines (e.g. Hohle Fels female figurine, Hohlenstein-Stadel *Löwenmensch*) as somehow reflecting initiation. Pre-20 ka child/infant burials recovered from central Europe are often of neonates (Krems-Wachtberg 1–3, Dolní Věstonice ('DV-')4, etc.) (Einwögerer et al. 2006; Svoboda 2006): presumably too young to have been initiated before death, but which are sometimes accompanied by considerable investment of time and resources (ochre, ivory, mammoth scapulae). These child burials are also marked by their proximity to domestic contexts, rather than being hidden in relatively inaccessible locations. Identifying more complex, transegalitarian cultures in the Upper Palaeolithic that valued women (as means of wealth transfers) and children (as means for investment of surpluses in expensive maturation ceremonies that increased value at marriage) is perhaps easier for Lateglacial (post-20 ka) inhumations, when the number of elaborately buried (including rich grave-goods) females achieves greater parity with males. Before 20 ka, relatively few females were given such treatment (DV-3, Crô-Magnon 2, Pataud, Ostuni 1, Brno III, and possibly the now-missing Sunghir 8: Pettitt 2011; Trinkaus et al. 2014). It is thus difficult to evaluate Hayden's (2003: 130) contention that a significant increase in the burial (sometimes with great wealth) of women and children occurred in the Upper Palaeolithic, unless one focuses on the Lateglacial.

Burials are perhaps the best-explored aspect of Upper Palaeolithic funerary practice, but fragmentation and other procedures seem to have been commoner. There are no clear burials for the Aurignacian, and Gravettian, Solutrean, Epigravettian and Magdalenian funerary practices are varied (Henry-Gambier et al. 2004; Fabbri 1992; Garralda 1992; Le Mort & Gambier 1992; Straus et al. 2015; Henry-Gambier 2018). Funerary practices do not simply consume resources; the dead (whether complete inhumations or isolated body parts/skeletal elements) can be treated as resources in their own right, e.g. cases where intentional deposition, selective redeposition, or fragmentation and transformation into pendants, grave goods, etc., can be demonstrated (Henry-Gambier et al. 2004; Svoboda 2006; Trinkaus et al. 2014; Straus et al. 2015). Discrete body parts and elements were sometimes found in association with burials (Sázelová et al. 2018). We may ask if Aurignacian and Gravettian examples of perforated human teeth (Henry-Gambier et al. 2004; Svoboda 2006: 26) represent personal items, given they are adapted to be carried on the person. Whether they were personally owned or held in trust for a group, their final resting places are not distinctive or structured, so it is impossible to say more about their potential significance for inequality: why might they have been discarded as if waste?

Sunghir individual 4 is more straightforward: the deliberate deposition (following a long period of curation and treatment with red ochre) of this femoral diaphysis in association with Sunghir 2 gives it a clear context, which gains additional significance when the genetic relationships of Sunghir individuals 1–4 are considered (Sikora et al. 2017). None of these four males was closely related (i.e. was more than three generations apart), and there are subtle differences in the materials and treatments accorded different individuals. While many features are shared between Sunghir 1–3 (mostly the wealth of body adornment and ochre, indicating the wearing of richly decorated clothing), there are quantitative and qualitative differences (Appendix D). The Sunghir 2 and 3 juveniles have more ivory beads than the mature adult Sunghir 1, scaled about two-thirds smaller than those associated with the latter (White 1993), allowing large numbers to be incorporated onto the smaller clothing worn by children. Other ivory objects ('bracelets') were numerous on the arms of Sunghir 1, but were present in lower quantities on Sunghir 2 and 3, who instead were accompanied by ivory 'lances' and lattice-worked ivory discs. Both Sunghir 1 and 2 had several dozen perforated fox canines on their heads (caps/hoods?), but Sunghir 2 also had at least 250 pierced fox teeth incorporated into a belt, as well as an ivory mammoth sculpture placed under his left shoulder (close to where Sunghir 4 was laid) (Trinkaus et al. 2014; White 1993). These three inhumed individuals consumed resource quantities at levels currently unknown for other Upper Palaeolithic funerary sites; not only were the graves richly provisioned, but the grave-goods were personalized. This conspicuous consumption would certainly imply inequality of treatment (the other inhumations at the site were probably slightly later, and seem to have been less richly provisioned), but the puzzle is that the environment was not particularly productive (Appendix B). Could transient inequalities (and ascribed status) have arisen in this peripheral group, perhaps based on *ritual* rather than socio-economic controls, without needing a secure resource base that produced consistent surpluses? The thousands of body ornaments that were included in the burials would have taken over 10,000 hours of material collection and production time (White 1993), but such activity must have preceded the deaths: were old materials/artefacts included in the burials, and thus taken out of circulation? Bader recorded a felid paw, clusters of ivory beads, 'apparently from discarded clothing' (Trinkaus et al. 2014: 16), as well as perforated fox teeth, broken pieces of ivory spear, small pierced stone pendants and ochre, in the cultural layer at Sunghir, implying these artefacts and resources were not confined to the burials. Central European Pavlovian funerary practices (some inhumations) also incorporated resources, but in lesser quantities than seen at Sunghir. Some superficial similarities are present between the two regions, e.g. use of perforated canid canines, ivory pendants and ochre in inhumations, but there are also differences: (modified) mammoth scapulae capping some burials (Pavlov 1, DV-4, Brno II, Krems-Wachtberg double burial, Předmostí I), and the Dolní Věstonice Triple Burial was essentially laid on the ground surface, associated with hearths, and covered with a wooden structure (Trinkaus et al. 2014; Svoboda 2006, 2008; Einwögerer et al. 2006). Many human remains at these sites are fragmentary (individual bones and teeth; isolated body parts), and scattered in the cultural layers, making them impossible to relate to particular resources and/or objects (Svoboda 2006; Trinkaus et al. 2000, 2010, 2017).

Can we identify the lineage-based expenditure of resources on funerary treatments of the dead, primarily inhumations? The aDNA evidence indicates exogamous mating networks for Sunghir (Sikora et al. 2017), and all genomes come from males of heterogeneous lineages, while dietary data (stable isotopes and zinc traces) imply that Sunghir 1–4 did not consume the same diets (Appendix D). Some level of dietary heterogeneity does not disprove a lineage-based control of food for elite individuals (Appendix A), but it does make it difficult to be certain such a socio-economic structure existed at Sunghir, particularly as we lack remains from more group members to test the isotopic and mineral trace values and aDNA. Some individuals from Dolní Věstonice, Pavlov and Krems-Wachtberg have yielded aDNA (Fu et al. 2013, 2016; Posth et al. 2016), showing some intra-site lineage diversity. It has been suggested that two of the three males from the Dolní Věstonice Triple Burial (DV-14 and DV-15) shared a mitochondrial haplogroup (U5), and thus a maternal connection (Fu et al. 2013: 556), with DV-13 possibly being a paternal half-brother (Mittnik et al. 2016: 5). However, it should be remembered that the similarities in mitochondrial and Y-chromosome haplogroups at Sunghir were interpreted as more distant relationships after more detailed genomic analyses (Sikora et al. 2017). If the individuals of the Triple Burial were closely related, the allocation of resources to their inhumation might have been based in lineage. The Pavlov 1 and DV-16 burials share mitochondrial and Y-chromosome haplogroups, but we cannot be certain they were contemporaneous or diachronic members of a lineage. While these Dolní Věstonice and Pavlov individuals were buried with grave goods, the quantities and variety of the latter do not match those seen at Sunghir, despite the greater environmental productivity of the local area. More genomic work is needed on these Central European Gravettian burials before we can speak with confidence about marriage network structure. Ancient DNA from isolated human skeletal elements (DV-42 and DV-43, both found close to central hearths in a settlement unit (Svoboda 2006)) adds some mitochondrial haplogroup diversity, but these remains were not accompanied by any resources (i.e. grave goods): were they themselves 'resources' in social or symbolic activities?

The re-use of space, and sometimes of human body parts, could have operated at all scales of access, from private (individuals or sub-groups) to whole groups or aggregations. If DV-42 and DV-43 were re-used in domestic contexts, near central hearths, this use might imply sub-group or group involvement. Other examples, owing to space restrictions, might have involved rather more restricted numbers of participants. While the El Mirón 'Red Lady' was buried in a relatively large cave, the grave was in a restricted part of the site, behind a large block and *c.* 2 m from the cave wall (Straus et al. 2015). The original inhumation, and subsequent removal of body parts (cranium and most of the long bones) might thus have been conducted by a restricted number of participants. The burial contained objects (pendants, needle fragments, antler projectile tips, etc.) that cannot be confirmed as part of the burial (Gutiérrez-Zugasti & Cuenca-Solana 2015); only a covering of red ochre was re-applied to the bones after they had been disturbed (Marín-Arroyo 2015). This ochre was presumably specially obtained for this purpose (from a source *c.* 26 km to the north), as the ochre elsewhere on the site was more locally sourced (Román et al. 2015).

If the surviving Upper Palaeolithic individuals were specially selected for funerary treatment, their consumption of resources did not follow a standardized pattern, either within or between sites, or whether synchronous or diachronic. While there are some repeated traits (e.g. use of ochre, body adornment and grave goods), the individuals themselves display heterogeneous nutritional, activity and ontogenetic histories, even given the fact that we lack remains for most people from the period. Such funerary sites were not restricted to the most productive areas (southwest France, Moravia), but also occurred in unproductive peripheral occupation regions (Paviland, Sunghir). Given the scanty British record of the Gravettian (Jacobi & Higham 2011), it is not even certain that the individual buried at Paviland was a long-term local resident; he could have spent much of his life elsewhere in Europe (including land now submerged by sea).

While the wealth and variety of animal resources exploited in Dolní Věstonice and Pavlov might have led some researchers to label them 'feasts' (Wojtal et al. 2012, 2018), there is no evidence to suggest single events of resource mass-consumption. The evidence for large-scale consumption of stored food is equally contentious. While some pits in Upper Palaeolithic sites on the Russian Plain and central Europe (Soffer 1985, 1989) have been interpreted as for storage (for bones or meat still on the bone) within or just outside dwelling structures, other researchers have questioned whether the contents of some pits were primary (i.e. fresh meat, inferred from articulated skeletal elements) or secondary (i.e. waste disposal) (cf. Soffer 1989; Iakovleva et al. 2012; Svoboda et al. 2016). Further west in Europe, away from permafrost conditions, evidence for clear storage pits is absent. Stellmoor implies the storage of seasonal surpluses, but the method of preservation is unclear (drying or smoking fillets, or immersion of carcasses?), and no storage features were identified. The same is the case for storage of foods that serve more as condiments to provide variety or improve taste, than as main dietary components: there is certainly potential to hide stores/caches of such materials (fungi, etc.) in secret locations for exclusive use by certain members of a group, but archaeological testing would demand a large sample of human remains (e.g. catastrophic death assemblage of a group) to test the composition of each member's dental calculus (cf. Power et al. 2015).

Evidence for physiological stress in Upper Palaeolithic human remains varies, but does demonstrate dietary fluctuations in both Moravia and Sunghir: such evidence might imply a lack/absence of storage to mitigate resource instability. While Harris lines (transverse lines in long bones) are relatively rare in Moravian Gravettian human remains (minor defects in DV-14 and DV-15 (both from the Triple Burial), DV-16 and Pavlov 1), they are much more pronounced and common in Sunghir individuals 1, 2 and (especially) 3, representing possible stress episodes (malnutrition and/or disease) (Trinkaus et al. 2006, 2014). Dental stress indicators (interruptions of tooth growth: linear and and pit enamel hypoplasias) are more common in Upper Palaeolithic humans from Sunghir and Moravia, generally indicating that individuals encountered most stress post-weaning (*c.* 2–5 years old) (Trinkaus et al. 2006: 456; 2014). However, Sunghir 3 had at least three separate (dental) stress events between the age of 1.5 and 5.6 years old, with Harris lines continuing until his death at the age of about ten (Trinkaus et al. 2014: 289–90). This individual also had bowed femora, as did DV-15, implying that mobility for both individuals was not easy, yet both show clear evidence of active lives (Trinkaus et al. 2006: 444; 2014: 288). DV-15 shows osteo-arthritic evidence of repetitive loading on the right arm and hand in particular (the left hand of DV-13 shows a similar pattern), implying the dragging of heavy loads beside/behind the body, perhaps using a strap (Trinkaus et al. 2006: 428, 443). Sunghir 1 (*c.* 35–45 years) had osteoarthritis in his thumbs, midcarpals and wrists, related more to activity levels and joint overloading than to age (Trinkaus et al. 2014). No such stress indicators have been identified in the surviving long bones of the El Mirón 'Red Lady,' perhaps indicating greater dietary stability in some Lateglacial groups (Carretero et al. 2015: 24). Upper Palaeolithic thus remains show a variety of activity levels and stresses, making it difficult to categorize individuals as 'elites' or 'transegalitarian.' Among the adults, osteoarthritic lesions related to repetitive, intensive tasks are common, but we cannot yet be confident in distinguishing craft/specialist activities from a palimpsest of different activities over the course of a lifetime.

Conclusions

Summarizing the evidence for the European Upper Palaeolithic, it is hard to support interpretations of consistent, structural transegalitarianism. Instead, I propose shifting patterns of Upper Palaeolithic resource consumption and ritual control that appear to mimic some aspects of the structural inequality stages defined by Hayden, but which appear to have been *ad hominem* rather than dynastic. Nevertheless, some changes over time are identifiable, e.g. some apparent differences in inhumations before and after 20 ka. Males seem to have been preferentially selected for funerary treatment and investment of particular types of resources in the period before 20 ka for some sites (e.g. Sunghir). LGM socio-politics were clearly subtle and diverse, probably varying by sex/gender, age and seasonal social organization (Wengrow & Graeber 2015), and reduced mobility/motility does not correlate with increased signals of inequality. The Solutrean is noted for its elaborate material culture, yet appears to lack any clear burials (unlike the preceding, more mobile Gravettian). The Magdalenian has complex and varied technology and funerary practices (including a more equitable proportion of female inhumations than seen earlier), yet its abundant art varies greatly in proficiency. There were certainly inequalities of resources, opportunity, outcome and ritual participation in the Upper Palaeolithic, though we should also remember there are inequalities of preservation and recovery that make it hard to establish baselines for the nutritional status and wealth of individuals. To what extent were individuals with elaborate funerary practices seen as special people by their groups? We do not have the remains of all their contemporaries against which to compare them, so tend to assume that buried individuals (primary and secondary inhumations) were intentionally important because they became fixed monuments in the landscape. Yet body fragmentation renders the dead portable on the person (e.g. Aurignacian human tooth pendants): would this behaviour be more suitable for highly mobile groups than for semi-sedentary ones (Table 9.2), given that it favours a personalized relationship with the dead rather than a spatio-temporally fixed, territorial-monumental one? Some sites fall between these poles of motility and immobility, such as the inhumations that were post-depositionally re-worked and bones removed. The fate of the missing long bones from the El Mirón 'Red Lady' burial is unknown: they might have been re-buried elsewhere, kept for use in ceremonies ('talismans' *sensu* Hayden (2003, 132)?), or fragmented/destroyed.

The ritual complexity of Upper Palaeolithic groups indicates strong potentials for inequality, but accompanying economic evidence is not available to support interpretations of transegalitarianism. Economically, resources were seldom stable enough to support the production of surpluses, implying that storage for was needed for lean seasons, rather than to support a non-productive elite. This apparent disconnection between overall environmental productivity and ritual complexity (e.g. Sunghir and Paviland) means we have to consider more nuanced, and possibly non-analogue, explanations for the patterns we see. The problem of equifinality makes it hard to discard interpretations of broadly egalitarian societies (perhaps with some 'despots,' or sub-groups controlling ritual activity) in favour of stratified transegalitaranism. Motility, within relatively unpopulated Europe, combined with resource unpredictability in many areas, would have allowed communities a reactive response to despotism. The Upper Palaeolithic can be seen as a series of population responses to fluctuating environmental conditions, including variations in the degree of mobility. Mobility, documenting changing human responses to shifting environmental conditions and potentials, seems able to explain much of the archaeological record. Innovations can be seen in this context of mobility, rather than the need to invoke 'aggrandizers' to drive change. Even the trade and exchange of material goods might instead represent direct procurement by highly mobile populations, e.g. by individuals less tied to childcare commitments (Fig. 9.5: E). For much of the Upper Palaeolithic, people do not seem to have been sedentary enough to allow transegalitarianism to flourish (Table 9.2): the early Upper Palaeolithic and earlier Magdalenian show evidence for high mobility, while the less mobile Solutrean evidently did not feel obliged to mark territories with burials.

There is little evidence of warfare in the Upper Palaeolithic (cf. Table 9.1). It is possible that it was present, but that the victims' remains were fragmented and not buried (though some might have been turned into tooth pendant trophies?). The Sunghir 1 individual certainly met a violent death, but the motive (if it was intentional and not accidental) for his demise is impossible to ascertain (Trinkaus et al. 2014); none of the other penecontemporaneous burials at the site or in the European Gravettian shows similar evidence for death from a weapon. Perhaps a better candidate for warfare might be the individuals from Maszycka cave, who have been interpreted as the killing of a Magdalenian group by neighbouring (Epigravettian?) competitors (Kozłowski & Sachse-Kozłowska 1993: 170); however, this violence may have occurred in the context of dispersing populations, rather than competition between semi-sedentary groups. At present, the available evidence can be explained as 'sporadic revenge raiding' (Table 9.2), rather than organized warfare.

Given that so many Upper Palaeolithic environments have no modern analogues, and were very spatio-temporally variable, assumptions that late Holocene complex foragers can be transposed onto the late Pleistocene run many risks. Indeed, the Holocene groups of the Pacific Northwest Coast themselves show a range of socio-economic organizations, from small, thinly scattered and highly mobile at the start of the Holocene, to more sedentary, densely populated and complex socio-political organization rather more recently (e.g. Ames 1991). More attention needs to be paid to local conditions in Upper Palaeolithic locales before we can be confident in moving from contingent explanations to generalizing ones.

To take an important example, the Sunghir site and funerary complex offer many challenges and opportunities for our interpretations of inequality in the Upper Palaeolithic. The wealth exhibited in the two intact burial pits (Sunghir 1–4) is extraordinary, possibly derived more from deposits of subfossil ivory (finite resources) than ongoing local environmental productivity (i.e. live mammoths). The reindeer at the site are thought to have been the forest ecotype, and thus not long-distance migrants (Trinkaus et al. 2014: 7). Much more work is needed on modelling and testing NPP estimates for Sunghir, and in using stable isotope and strontium analyses (if practicable) to tease apart the movements of prey species. More detailed evaluation of the economic basis and ecology of this locale would allow the extant data on nutritional status of the surviving individuals to be set into a more detailed exploration of potential inequalities. Currently, aDNA from Sunghir 1–4 indicates exogamous breeding networks, implying more open (not closed) social networks (Gamble 1999) that are less compatible with transegalitarian societies (Table 9.2; Appendix A). Yet the preponderance of male burials at the site implies some degree of male control of ritual knowledge (not necessarily of inequality in other socio-economic spheres: Appendix A). In contrast, the reworking, and re-resourcing, of the El Mirón female burial might imply more involvement of women in ritual knowledge.

Such detailed, localized studies need to be replicated across the full spatio-temporal span of the Upper Palaeolithic, wherever the evidence is (potentially) available. They are our best hope of reducing the effects of equifinality, given that outcomes and traits can have several explanations. The range of variability within Upper Palaeolithic technocomplexes means that we cannot generalize for each one: we cannot assume they are meaningful 'cultures' in an ethnographic sense. Few archaeological data are direct measures of a socio-economic aspect; most are proxies, from which archaeologists infer heterogeneous interpretations. More direct measures of behavioural complexity (strontium and stable isotopic analyses; aDNA) can be augmented by detailed study of site-formation processes (taphonomic factors need to be assessed before complex behaviour can be asserted) and experimental evaluation of important features (reconstructions of some large dwelling structures, e.g. on the Central Russian Plain, would benefit from rigorous testing of their viability). Testing the individual components of these structures will also provide information on the sources of materials used, and how landscapes were provisioned: caches of resources and tools, burial goods, and the resourcing of structures and artworks in deep cave systems. Once positioned, many of these concentrations of material can be viewed as caches, whose materials could be recombined or re-positioned as desired. In this sense, the mammoth dwellings at sites like Mezhirich were monumental constructions that required considerable labour for initial construction (Soffer 1985), but which could then be used as 'caches' of material suitable for other structures or purposes, if required. Likewise, the El

Mirón 'Red Lady' burial's status could have shifted after initial inhumation, as the burial was re-worked and its contents altered. In general, construction was a process, not an event.

When we set about evaluating inequalities in the Upper Palaeolithic, using ideas derived from the ethnographic record, it is useful to bear the following questions in mind:

- Scales of analysis: can we reach meaningful spatio-temporal scales in the Upper Palaeolithic for evaluating inequalities?
- How do we test the archaeological record against palaeoenvironmental proxies and reconstructions? Are there modern analogues for these environments?
- Can sex-based (and gendered) differences in application and control of ritual knowledge be identified, and at what spatio-temporal scales did they operate?

Huge strides have been made in the detailed, interdisciplinary study of the Upper Palaeolithic in recent years. It is now not beyond our ability to start unravelling the causes of equifinality.

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Note

1. The appendices to this chapter appear at the end of the online edition of the volume.
2. …Durant le période glaciaire, les plaines de l'Ouest de l'Europe étaient couvertes de prairies d'une richesse inégalée, parcourues par une abundance de mammifères susceptibles d'être chassés' (Hayden 2008: 82).

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Chapter 10

A comparative perspective on the origins of inequality

Matt Grove

This paper offers a comparative perspective on the origins of inequality, using examples from primates and other animals in an attempt to illuminate the capacities for and manifestations of inequality in our species. At its heart is the finding – well-studied and long-established – that social inequality is rife in the animal kingdom. This is accompanied by the twin suspicions that 1) inequality was the ancestral hominin condition and 2) we have not in fact deviated too far from this condition at any point in hominin evolution. These suspicions are raised by even a cursory glance at the available comparative data, but are further reinforced by the examination of a curious methodological anomaly that persists within archaeology and anthropology. Evolutionary biologists, ecologists, and zoologists begin with the assumption that individuals are self-interested, and that inequalities in access to food, mates, and other resources automatically follow. Researchers in these disciplines have spent considerable time (and achieved some of their most notable breakthroughs) studying and deriving explanations for instances in which this appears *not* to be the case. Archaeologists and anthropologists, by contrast, begin with the assumption that individuals were at some point in the past fundamentally egalitarian, and seek to show how this may in fact have benefitted them in the wider social context. The uncritical adoption of this assumption of ancestral egalitarianism then motivates us to devote considerable amounts of time to explaining the apparently *de novo* appearance of human inequality.

A simple argument from parsimony, however, suggests that there is likely to be little validity to the assumption of ancestral egalitarianism (see Fig. 10.1). All primate species, including humans, show widespread instances of social inequality today; this suggests that the ancestral state was also one of inequality. The assumption that the ancestral hominin state was one of equality requires not one but two reversals on a single, peculiar branch of the tree. First, at some point after the last common ancestor with chimpanzees, the lineage represented by this branch evolved towards a state of egalitarianism. Then, at some later time, this lineage evolved back towards the state of inequality from which it had arisen, such that today it matches all other terminal nodes of the tree. This scenario is, of course, highly unlikely relative to the alternative: that egalitarianism was simply never a feature of human evolution.

What follows is not a systematic, phylogenetically controlled study, but rather a series of examples chosen to highlight the similarities between humans and other animals (particularly other primates) in key areas, and to suggest that we should give serious consideration to considering inequality as the ancestral state. This approach is not intended to suggest that equality or inequality are in any sense genetically determined, but rather that the inertia of ancestral social systems is likely to exert selective pressures favouring individuals best suited to those systems. Running through much of the paper is an attempt to distinguish *differences* from inequalities, and an investigation of whether the former may be more visible archaeologically. The paper concludes with suggestions on the kinds of differences that might be easily and frequently observable in the archaeological prior to the advent of farming.

The state of nature

One advantage of adopting a comparative perspective on the origins of inequality is that it permits analysis of the circumstances under which inequalities pertain in other (more or less closely related) species. It therefore enables us to provide novel insights into the 'state of nature' debate that has so often featured in anthropological discussions of (in)equality (e.g.

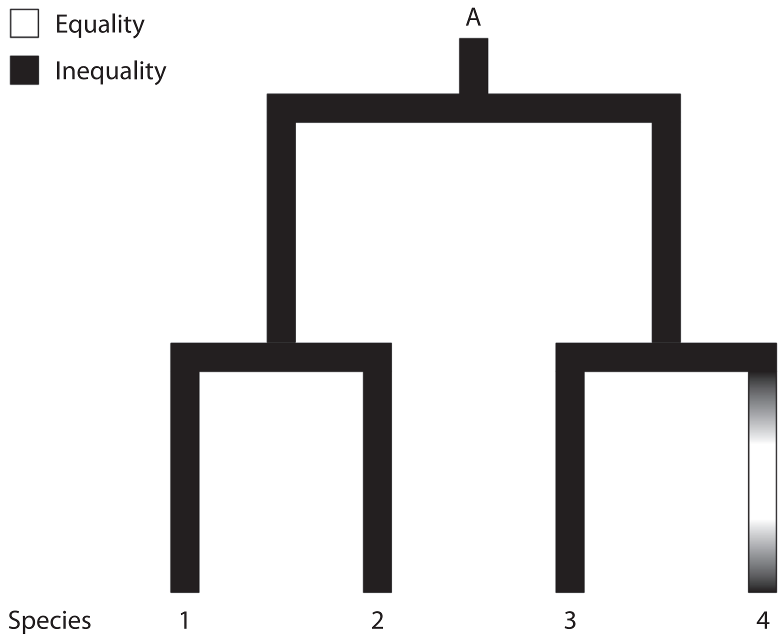

Figure 10.1. *Four species share a common ancestor at A; since all species show inequality, we assume that this was also the case for A. Arguing that species 4 evolved towards a state of inequality from one of equality also necessitates a prior reversal; the species must have first evolved from a state of inequality to one of equality. A more parsimonious argument would suggest that neither of these reversals occurred.*

Testart 1988, 1989; Widerquist & McCall 2015). This debate – which is quite distinct from that raised by evolutionary psychologists over the alleged 'environment of evolutionary adaptedness' (*sensu* Cosmides & Tooby 1992) – is often framed as a discussion of the relative merits of Hobbes' *Leviathan* (1651) and Rousseau's *Discourse on Inequality* (1754) or the subsequent *Social Contract* (1762), but poetic renderings of similar sentiments have also made a lasting impression on anthropological dialogues. A particularly enduring image, published some 90 years before the *Social Contract*, is that of Dryden's 'noble savage'. The phrase is spoken by Almanzor, a Moorish warrior at the Battle of Granada, revoking the impositions of the Moorish King Boabdelin:

I am as free as nature first made man,
Ere the base laws of servitude began,
When wild in woods the noble savage ran.

This embodies the sentiment, often attributed directly to Rousseau, that the state of nature is one of unconstrained freedom; that laws imposed upon this state will lead inevitably to an erosion of that freedom, and ultimately to inequality through unjust governance. Boabdelin's response is distinctly Hobbesian, asserting that as Almanzor recognizes no power above his own, he should be recognized as a common foe to all mankind, and 'hunted like a beast of prey'. This echoes Hobbes' notion of the state of nature as a war 'of every man against every man', and finds its most lasting expression in Tennyson's notion of 'nature red in tooth and claw'. Thus the Dryden / Rousseau image of the state of nature evokes freedom and equality; it accords with the use of the term 'primitive' to mean 'pristine'. Hobbes and Tennyson, by contrast, assert that freedom can only be achieved through the imposition of a social order that removes the danger of overt and endless competition; here 'primitive' means simply 'uncivilized'.

Rousseau develops the argument that a social contract should emerge organically and, though regulated by government, it should also be subject to dissolution if that government begins to extend its power beyond the remit approved by the populous. For Hobbes, governance must be imposed rather than organic, because the natural self-interest of individuals prevents their acting collectively in service of the greater good. Though an abundant literature on game-theoretic scenarios demonstrates that self-interest is not necessarily a barrier to cooperation (e.g. Hamilton & Axelrod 1981), a more intriguing argument involves the possibility that individuals possess an innate or developed moral sense, or at least an aversion to demonstrable injustice. This possibility has been investigated extensively by economists and sociologists (e.g. Fehr & Schmidt 1999; Camerer 2003; Güth & Kocher 2014); from a comparative perspective, it is of particular interest that theories developed to explain the dynamics of contemporary human markets have also facilitated the study of 'inequity aversion' in primates and other animals.

'Inequity aversion' (IA) describes the tendency of individuals to resist inequitable outcomes. In practice, this involves refusing a transaction because the benefit received is perceived to be either too small or too large relative to that of others. Like cooperation, IA has been studied with great simplicity and clarity via game-theoretic approaches that ensure self-interested and inequity averse strategies result in opposing actions. Although there are other formalizations, the results discussed here rely primarily on the 'ultimatum game' and a series of non-verbal equivalents used to test for the presence of IA in primates and other animals. In its basic form, the ultimatum game involves a decision about how to distribute a resource. A proposer, in possession of the resource, offers a proportion of that resource to the responder, who can either accept or reject this offer. If the responder accepts the offer, she receives the proportion of the resource, with the proposer retaining the remainder. If the responder rejects the offer, however, both the proposer and responder receive nothing. In a related formulation known as the impunity game, rejection by the responder *does not* prevent the proposer from receiving her share. Note that in both formulations a purely self-interested proposer would offer as little as possible, and a purely self-interested responder would always accept, since provided the offer is greater than zero it represents a gain, regardless of its size. Thus when an offer of is rejected, it suggests IA rather than self-interest on the part of the responder. Most studies of IA in non-human primates and other animals implement analogues of the impunity game, in which the proposer's motivation to share should be reduced, since rejection does not affect her payoff.

'Since the offer is a *proportion* of the resource, it must vary between 0 and 1. It is therefore possible to delineate two types of IA that depend on whether the offer is greater than or less than 0.5. First-order IA occurs when the responder refuses an offer of less than half the resource; in such cases, the responder is reacting to an offer that is perceived to be unfair to herself. Second-order IA occurs when the responder refuses an offer of more than half the resource; in such cases, the responder is reacting to an offer that is perceived to be unfair to the proposer. Myriad ultimatum game experiments with human subjects demonstrate that responders routinely reject unequal offers (e.g. Camerer 2003; Güth & Kocher 2014), exhibiting both first- and second-order IA. Though the proportion offered by proposers differs cross-culturally (e.g. Camerer 2003; Henrich et al. 2004), it averages at approximately the equality condition of 0.5 (e.g. Henrich et al. 2004). Recent experiments also demonstrate first-order IA in chimpanzees (Brosnan et al. 2005, 2010; Proctor et al. 2013), capuchins (Brosnan & de Waal 2003; Fletcher 2008; Takimoto & Fujita 2011), macaques (Massen et al. 2012), corvids (Wascher & Bugnyar 2013), and domestic dogs (Range et al. 2009, 2012; Horowitz 2012). Second-order IA, however, appears on the basis of current research to be limited to humans and chimpanzees (Brosnan et al. 2010; Proctor et al. 2013). An interesting compliment to this phylogenetic pattern is the finding that 4 to 7-year-old children demonstrate first but not second-order IA, whereas 8-year-old children demonstrate both (Blake & McAuliffe 2011; Blake et al. 2015).

Brosnan & de Waal (2014: 1) note that inequity aversion is primarily of benefit to species in which individuals cooperate with non-kin, arguing that the sense of fairness evolved not 'for the sake of fairness *per se*, but in order to reap the benefits of continued cooperation'. In this sense IA may be a mechanism similar to reciprocal altruism, in which a self-interested agent sometimes benefits from behaving 'altruistically' (e.g. Trivers 1971). If in repeated trials of the ultimatum game the proposer and responder regularly reverse roles, it may be possible that a 'fair' division (i.e. = 0.5) emerges via reciprocity; equivalently, it may be possible that generosity on the part of the proposer enhances her reputation, leading to benefits in currencies other than those directly involved in the game. IA may also depend on cognitive abilities similar to those required for reciprocal altruism, such as memory for previous exchanges or the ability to predict another's response to a given action. In the case of second-order IA, such abilities are clearly present in at least chimpanzees and humans, while in the case of first-order IA they extend to a number of more distantly related primate species. The comparative perspective therefore suggests that the capacity for recognizing and reacting to inequity may be phylogenetically ancient. Equally ancient, however, is the tendency for ultimately selfish motivations to usurp that capacity in practice, as individuals pursue their natural self-interest at the expense of other group members, seeking advantageous access to resources or mates. This pattern is analogous to the collapse of cooperation in the presence of free-riders, and leads to various examples of social inequality in primate societies. Below, I focus on two examples of primate social inequality that are of particular relevance to the study of human evolution, and argue that we should not view the ancestral state as one of (social) equality. On balance, the study of primate societies lends considerably more support to Hobbes than to Rousseau.

Primate inequalities

The first and perhaps most obvious situation in which inequality is manifest in primate groups is the dominance hierarchy. Though primates as an order demonstrate a range of social structures from the egalitarian to the 'despotic', classic linear hierarchies are perhaps the simplest case. These appear in a number of baboon and macaque species, and are maintained through threat behaviours and occasionally violent confrontations. Strict linearity implies that, for example, the dominant or alpha male always prevails in competitive situations against any other male, with the beta male prevailing against all males but the alpha, and so on down the hierarchy. In baboon and macaque societies there are linear hierarchies within both males and females, with males dominant over females in most cases. These hierarchies become more rigid, and confrontations more frequent, in harsher environments when food is less plentiful. Dominance is also correlated across the various currencies of benefit; for example, the alpha has primary access to both food and mating opportunities.

The pervasiveness of dominance hierarchies in primates – even those species shown in experimental studies to display inequity aversion – demonstrates that an appreciation of 'fairness' is a necessary but not a sufficient precursor for the emergence of egalitarian society. There are a number of informative differences, however, between dominance relations in humans and those in non-human primates. Of particular interest is the fact that dominance relations in primates can be highly dynamic, and related to this is lack of a clear system through which dominance positions can be inherited from parents to offspring. Baldwin (1968), for example, demonstrated numerous changes in the ranking of four adult male squirrel monkeys over the course of just four months; over this period only one of the four males failed to attain alpha status, and it was not unusual for the lowest ranking male to become the highest ranking as the result of a single challenge to the previous incumbent. Dominance relations in primates may reflect intrinsic differences such as age, weight, or strength, but they can also rely on alliances between individuals; in many species, dominant males require the support of females in order to retain their positions (e.g. capuchins, Fedigan 1993; gorillas, Watts 1996), with females in turn benefitting from the predator detection and defence behaviours of dominant adult males. What is missing, however, is a clear structure through which dominance can be inherited, and this potentially explains why dominance relations remain fluid rather than entrenched.

Although there are intriguing counterpoints – Kawai (1958) found that infant Japanese macaques 'inherited' positions immediately below their mothers in the group dominance hierarchy – the nature of inheritance in human societies is for the most part qualitatively different from anything that exists in non-human primate societies. Inheritance in human societies is generally discussed in terms of 'wealth', but as Borgerhoff Mulder and colleagues (2009) make clear, wealth can be understood to include not only resources, but also information (both genetic and cultural), relationships, territory, and a number of other factors that ultimately have the potential to elevate reproductive success. At least some of these factors are *inheritable* in non-human primates, yet in the vast majority of cases none are actually inherited. Thus 'persistent institutionalized inequality', defined by Mattison and colleagues (2016: 185) as 'differential access to power or resources involving institutionalization of status hierarchies by hereditary privileges', does not exist in non-human primate society. The vast majority of non-human primates live in unequal societies, yet in many this inequality of outcome may have developed despite equality of opportunity; high levels of inter-generational wealth transmission in human societies ensure that the opportunities themselves are also unequal.

A second situation in which social (in)equality can be examined in primates is that of food-sharing. Since this an apparently altruistic process, it is informative to study the individual motivations for and patterns of food-sharing in primates to ascertain whether food is distributed equally, or whether particular individuals are favoured. Food-sharing has long been a central tenet of ethnographically informed archaeological models of human evolution, particularly when combined with the transport of resources to a central location (e.g. Isaac 1981, 1983). As is often the case, this line of reasoning appears to have been motivated by the idea that food-sharing is a uniquely human behaviour. Thus Isaac (1983: 534) imagines the baffled reaction of a chimpanzee: 'these humans get food and, instead of eating it like any sensible ape, they haul it off and share it with others'. Since Isaac's pioneering archaeological work, however, research into primate food-sharing has expanded considerably, to the extent that it is now known to be relatively common (e.g. Feistner & McGrew 1989; Brown et al. 2004).

A recent review by Jaeggi & van Schaik (2011) found that in 12 of the 68 primate species for which data were available food was shared with non-kin adults (and in far more cases with kin, particularly offspring). Such sharing occurred in all great apes surveyed except the gorilla. Although sharing is often passive (i.e. it may take the form of tolerated theft or a response to harassment), Jaeggi & van Schaik (2011: 2126) make the important point that the distribution of food may still be unequal, with possessors of food choosing to tolerate theft only from particular individuals. In such cases, sharing may be targeted towards particular individuals, may reinforce reciprocal relationships, and may be reciprocated in other currencies, as appears to be the case in both orangutans and chimpanzees. In both these species, food-sharing appears to be highly tactical, with apparently altruistic acts being reciprocated within particular sub-groups.

Van Noordwijk & van Schaik (2009) report consistent patterns of tolerated theft among orang-utans, with food routinely passing from males to females. Often, the shared items – pieces of fruit, vegetable matter or pieces of termite-infested wood - were of limited nutritional value and would not have been overly difficult for either the male or the female to obtain. Thus the tolerance of theft by males appears to serve a primarily socio-sexual function, allowing them to maintain associations with females who might otherwise leave, seeking out associations with other males elsewhere. Van Noordwijk & van Schaik (2009) further propose that attempts to take food by females constitute tests of a male's tendency towards coercion and aggression, both of which are prevalent in sexual settings among orangutans. Although no short-term trading of food for mating, grooming, or agonistic support was observed, males who tolerate theft by females may increase their likelihood of mating opportunities in the longer term.

The existence of tactical food-sharing in our closest cousin, the chimpanzee, has been more extensively studied, and demonstrates the diversity of motivations that might lead to the unequal treatment of conspecifics (de Waal 1997; Mitani & Watts 2001; Slocombe & Newton-Fisher 2005; Gilby 2006; Hockings et al. 2007). Of particular interest in terms of human evolution is the sharing of meat among chimpanzees. It has been hypothesized that meat-sharing between males reinforces social alliances, and that sharing of meat by males with females increases mating opportunities. Mitani & Watts (2001) performed detailed analyses of meat-sharing events between chimpanzees at Ngogo, Kibale National Park, Uganda, with their results suggesting that male-male alliances are the most important feature in structuring exchanges. Meat was shared non-randomly and reciprocally among males, and was strongly associated with coalitionary support. Meat was shared infrequently with females, and although sharing was more likely with oestrus than anoestrus females, this did not lead to mating advantages.

The fact that meat is shared non-randomly among male chimpanzees indicates that favoured partnerships can emerge; such partnerships are then strengthened through reciprocity into alliances that facilitate the progress of males towards the upper reaches of the dominance hierarchy (de Waal 1982; Goodall 1986). That food-sharing, so often seen as a hallmark of human society, exists in our closest primate relatives and is used primarily to reinforce the coalitionary and dominance relations that are perhaps the clearest example of primate social inequality, should make us think carefully about our supposedly egalitarian origins. Hypotheses regarding the individual benefits of food-sharing have also been tested with data from human foragers, with many similar hypotheses garnering support. Although reciprocity in food-sharing can reduce subsistence risk and lead to a form of 'long-term egalitarianism' it is also vulnerable to free-riders and can generate and reinforce inequality when subsets of individuals reciprocate primarily or exclusively with one another (e.g. David-Barrett & Dunbar 2014). In this sense, food-sharing should not necessarily be seen exclusively as a way of 'averaging out' the differences between individuals; it is also a way in which those differences can be amplified over time. Such effects can be even more noticeable when individuals take on different roles in communal activities, as is now amply demonstrated in a diverse range of species.

Inequality and difference

The above discussion of chimpanzee meat-sharing considered only the division of the spoils of the hunt, rather than the coordination of the hunt itself. Whilst chimpanzees generally hunt in groups, some groups pursue prey as a series of individuals, each performing essentially the same actions (e.g. in hunting red colobus at Ngogo (Mitani & Watts 1999)). In other groups, individuals adopt different roles and appear to coordinate their actions towards the common goal (e.g. in hunting of juvenile baboons at Gombe (van Lawick-Goodall 1968)). That individuals form 'teams' in this way provides a novel angle on the issue of inequality in groups. In particular, it raises an important distinction between difference and inequality which has important applications in archaeological studies of the latter.

To illustrate this distinction, and to provide a fuller discussion of the possibility that differences may ultimately lead to inequalities, a number of potentially illuminating examples from other species are considered. The first involves so-called 'sneaky matings' in olive baboons (Packer 1977), in which a pair of low ranking males form a partnership allowing them access to an oestrous female who would usually be guarded by the alpha male. While one of the pair engages the alpha male in an aggressive encounter, the other is able to move away and mate with the female without disruption, and with minimal risk of an attack by the alpha against either the female or the 'sneaky' male. Thus two quite distinct actions are undertaken by the two males of the partnership, who will at a later stage, and potentially with a different female, swap roles so that both will ultimately gain mating opportunities. This is clearly an instance of reciprocity, as well as an example of a case in which the concurrent performance of different roles by different individuals is essential to achieving a goal. Neither animal could succeed alone, and therefore the partnership provides benefits that individual actions could not. Whilst in any given exchange one animal is paying a cost while the other receives a benefit, in the longer term the payoffs for the two animals are equivalent. Equality is achieved through the reversal of roles.

Returning to the example of chimpanzee hunting reported from Gombe by van Lawick-Goodall (1968), some of the hunters surround the prey, driving it into the trees, whilst others climb neighbouring trees, ensuring that it is captured when attempting to jump to safety. Again, the collective nature of the hunt achieves a goal that no single chimpanzee could achieve alone, yet in this case differing roles appear to be adopted on an *ad hoc* basis, based on the prior actions of other individuals. Despite this collective action, there often exist both individuals who have participated in the hunt but do not receive a share of the prey and individuals who have not hunted but do receive a share of the prey. Although a collective effort is required to succeed, this is not recognized in the subsequent process of sharing, which reverts to the concerns regarding dominance and alliance formation highlighted above. The complimentary roles of the hunters are neither formally established nor rotated, as in the case of baboon matings.

There do exist, however, situations in animal behaviour in which individuals take on distinct roles in communal activities and stick to these roles for extended periods of time. One of the best examples comes from analyses of hunting behaviour in lions (Stander 1992). During hunts, lions frequently split into formations that allow them either to ambush prey or to corral them into situations in which they are effectively surrounded. In some cases individual lions will move away from the group, moving discreetly to the opposite flank of a herd of prey; they will then attack from this opposite flank, driving the herd back towards the majority of the group. In other cases the lion group will attack from one direction only, but certain individuals will move rapidly to the sides of the prey herd, corralling them into a central area where they are easier to attack. Potentially in the first example, and certainly in the second, some lions adopt the same role in each and every hunt. This is despite the fact that individuals in the left and right 'wing' positions must travel considerably further in order to encircle the herd (see Stander 1992: Figure 1). Intriguingly, even when group composition changed, individuals tended to stick as often as possible to their preferred positions in the hunt.

There exists among hunting lions a division of labour that involves individuals adopting different roles on a semi-permanent basis. This rules out the neat reciprocity explanation applicable to olive baboon 'sneaky matings', and is quite different to the apparently fluid way in which hunting chimpanzees adopt different roles on an *ad hoc* basis. The question of why the lions studied by Stander (1992) have adopted such a structured division of labour – with individuals taking on quite distinct roles in the course of repeated hunts – is clearly pertinent to both human hunting behaviours and the existence of labour divisions more generally. There are many aspects of this division of labour that enhance hunting success, and Stander's (1992) detailed consideration of the data suggests a number of explanations that might be generalized into basic theoretical principles. During the wet season, when prey is relatively densely distributed, it is possible for lions to hunt individually with considerable success, and this is generally what they do. In the dry season, however, prey are found in smaller groups and at lower densities, and rates of solo hunting success fall to unsustainable levels. Thus group hunting emerges as a response to seasonal fluctuations in precipitation. Furthermore, success in hunting groups is significantly greater when individual lions occupy their preferred roles in the hunt. The combination of coordination and specialization thus ensures success during seasons in which prey are scarce and harder to catch.

When considering the division of labour in human foraging groups, discussions often focus primarily on the sexual division of labour, for which adaptive explanations generally refer to the economic balance of a high-yield, high-variance resource with a low-yield, low-variance resource (e.g. Kaplan & Hill 1985; Gurven et al. 2000). There is also some suggestion that physical differences between males and females may predispose them towards hunting or gathering (though the finding that males hunt and females gather is not universal, and is further complicated by the fact that animal as well as plant resources can be 'gathered'). The sexual division of labour, however, is just one example of the way in which tasks can be distributed in a group, and may not be the most revealing example for the study of the way in which differences between individuals can lead ultimately towards social inequalities. In lions there is, in a sense, a sexual division of labour that underlies the hunting division of labour, in that it is primarily the females that hunt. I would argue that the division of labour *among* hunting female lions is more akin to specialization, with each individual establishing a particular, persistent role within the group. It is in the context of specialization that some of the most intriguing evidence for the presence of social inequalities prior to the Holocene can be found in the archaeological record. Though a focus on material culture forces us towards an examination of craft specialization rather than specialization *per se*, this does not overly diminish the opportunity for tracing examples of social difference in the archaeological record.

Difference and specialization

Whilst there is no evidence that the different roles taken by hunting female lions in the above example lead directly to differences in social status, a number of theoretical models suggest that even minor, random differences between individuals could do exactly that. In their simplest form, the 'winner-loser' models common in evolutionary biology assume a number of events in which individuals compete for a resource. The winner of a given competitive event will be more likely to win future events, due to the resource it has gained; thus slight initial differences, even if occurring randomly within a group, are multiplied over the course of repeated competitive events (e.g. Lindquist & Chase 2009). Importantly, differences on multiple axes may be correlated. If the resource is a food resource, it may lead to better nutrition and greater strength and size on the part of the winner, which may in turn lead to an elevated position in the dominance hierarchy and more frequent mating opportunities.

The above scenario is undoubtedly an oversimplification, but it demonstrates how simply, rapidly – and perhaps inevitably – differences between individuals become magnified to the extent that they become manifest as marked social inequalities. The remainder of this section examines an example in which differences – both between sites and between individuals – are archaeologically visible. It is hoped that this consideration of difference in an archaeological context will illuminate situations in which social inequalities are present but are not visible to archaeologists searching for more fundamental indicators. The idea of difference as an indicator of inequality suggests a different approach to the archaeological record – one which moves beyond the idea of (in)equality as a dichotomous variable and increases the number of archaeologically documented attributes that can be interpreted as having a direct bearing on the issue.

As a formative attempt to develop this perspective, the following paragraphs present a description of a series of interacting archaeological sites from the Upper Magdalenian of the Paris Basin. The description draws comparisons between the various observations of primate societies documented above and the extent to which the spatial division of tasks, specializations, and the presence of differences between individuals are evident at these sites. Magdalenian cultures first appeared in the Périgord during the beginning of the Tardiglacial, approximately 17,000 BP, and persisted until the end of the Pleistocene at approximately 11,700 BP. The earlier phases of the French Magdalenian were strictly confined to the southwest during the Older Dryas, but during the subsequent Bolling phase humans were able to spread north through the Loire Valley and into the southern part of the Paris Basin, ultimately reaching the Meuse plateau in northern Belgium. The archaeology of the period is divided into 7 tool phases (labelled 0–6), based on the sites of La Madeleine for the earlier and Laugerie-Haute for the later material. These later phases (4–6) are those represented in the Paris Basin, where they are combined with a distinctive blade-based assemblage featuring dihedral burins, becs and perforators (Audouze 1987; Gordon 1988). Bone and antler working are particularly prevalent, as befits a society for whom the hunting of reindeer was such a dominant means of subsistence. Faunal assemblages are often essentially monospecific, demonstrating the profound reliance on *Rangifer tarandus* that has led to the Magdalenian being described as 'l'âge du renne'.

Evidence of specialization is evident at multiple scales in the Upper Magdalenian of the Paris Basin. At the broadest scale, there is clear evidence of individual sites themselves playing distinct roles in the broader economy of the region. The idea that different sites could serve different functions is certainly not restricted to such recent material (see, for example, Leakey 1972 and Isaac 1997), but the articulation of differential production is certainly much clearer in the archaeological record of the Upper Palaeolithic than that of the Early Stone Age, and suggests that differences were designed rather than epiphenomenal. Enloe & David (1997), for example, conclude that Verberie was a hunting camp occupied by a specific task group, whereas Pincevent was 'occupied by consumers as well as producers' (ibid.: 55). Faunal remains suggest the removal of food-rich elements from the former site, whereas the latter displays a relatively complete faunal profile. By contrast, Etiolles is generally regarded as a blade production site (Karlin et al. 1992; Olive & Taborin 2002). Evidence of hunting at Etiolles is limited, and the site lies close to a source of remarkably large flint nodules. Further to the local raw material, non-local flint was brought to the site from the valleys of the Eure to the west, the Marne to the northeast, the Oise to the north, and the Loing to the south (Olive & Taborin 2002). Olive & Taborin argue that Etiolles was a point around which various travel routes revolved, such that mobile hunters were able to stock up on blade blanks for use at other sites.

At this broadest scale it is clear that distinct activities, such as lithic production and targeted hunting, occupied different places within the basin. Such evidence is not sufficient, of course, to assert with confidence that different tasks were carried out by different individuals; reindeer hunting involves exceptionally high mobility, and it is possible that these different localities were used by a roving population during different seasons of the year. Instead, it may demonstrate a move towards an economy increasingly dependent on delayed returns (*sensu* Woodburn 1982): an investment in lithic production prior to reindeer migration, followed by the storing of food following the windfalls created by intercept hunting of large herds. Yet there is also an intriguing parallel with the idea of teams in animal societies, introduced above. Anderson and Franks (2001: 535) define teams as groups whose members perform different subtasks concurrently, with each task being successfully completed if and only if all subtasks are undertaken. The major difference between a team of chimpanzees and a team of Palaeolithic reindeer hunters may therefore lie in the spatio-temporal extent over which the principle task is undertaken (see also Gamble 1999).

At a finer scale, the multiple localities at the site of Pincevent reveal evidence of reciprocity, yet they also reveal evidence of the different roles played by families and individuals, and demonstrate how differences can easily result in inequalities. Evidence of food-sharing at Pincevent has been demonstrated by the refitting of reindeer bone between hearths (Enloe & David 1992; Audouze & Enloe 1997), whilst at Etiolles the circulation of blade blanks between households suggests that 'several human groups that were united enough to help each other' camped together at the site (Olive & Taborin 2002: 102). Enloe (2001) regards the faunal evidence from Etiolles as representing the first unequivocal demonstration of food-sharing in the Palaeolithic. Yet more recent investigations by Julien & Karlin (2014) also reveal incipient differences between individuals at Pincevent. At Pincevent Level IV20, an autumn reindeer-hunting camp extending over some 5000 sq. m, these authors identify four families, totalling around 30 people. The four central residences plus peripheral workshops demonstrate the occurrence of spatially isolated activities including the manufacture of hunting weapons and the drying and preparation of hides. Julien & Karlin (2014) assert that the diversity of activities that took place among these individuals called for the presence of a 'project manager', an individual who they refer to as the 'celui-qui-sait'. Furthermore, the residence and workshop of this individual have been identified, and the transfer of both meat to and lithics from this individual show a highly evocative pattern.

Julien & Karlin (2014) argue that the transfer of reindeer meat, demonstrated via carcass refitting, from other families to the individual inhabiting Unit T112 demonstrates both that this individual hunted less often than others, and that (s)he was accorded a greater status than other members of the group. This was likely to be due to this individual's ability to produce exceptionally large blades, examples of which have been shown via refits to have been transferred to the residences of all other families. Thus far this might be evidence simply of barter for different commodities, but Julien & Karlin (2014) suggest that the 'one who knows' was both the organizer of hunting strategies and the head of the community, as evidenced by the position of Unit T112 facing the other residences of the group. It seems likely that the knowledge of advanced lithic reduction techniques – coupled with the skill required to produce successful blanks – accorded this individual a separate status within the group as a whole. Thus Pincevent Level IV20 represents an example in which what is at first observed as a difference between individuals – with one expert knapper producing blades for use by the wider group – can also be seen as a case in which the individuals of the group are accorded differing status.

Conclusions

The available evidence suggests that the 'state of nature' was a state of Hobbesian self-interest and inequality; this applies to the hominins just as it does to all other animals. Our close primate cousins, like us, have the ability to recognize inequity in social exchanges; yet they persist, like us, in structuring their social relations around various inequalities in access to resources. Dominance hierarchies and the preferential sharing of food are just two examples for which there is abundant evidence among primates and other animals. Yet primates and other animals also adopt different roles in social endeavours, working as teams towards common goals that they achieve regardless of the inequalities among the constituent team members. Individuals in such teams can be regarded as specialists, and it is in the literature on craft specialization that archaeologists may in turn find insights as to the inequalities that existed in prehistoric societies. Such a focus will allow us to trace inequalities far further into prehistory, beyond the current focus on the terminal Pleistocene and Holocene. It is readily apparent that in the archaeological search for evidence of prehistoric inequality there are some aspects we'll never see, some that we're not even looking for, and many that we have looked for, found, and interpreted via alternative perspectives. The evidence for specialization is a prime example of the latter, and viewing the differences produced by specialization as the raw material for inequality will considerably advance our understanding of what is likely to be a surprisingly ancient phenomenon.

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Chapter 11

Could incipient dogs have enhanced differential access to resources among Upper Palaeolithic hunter-gatherers in Europe?

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The dog is the only domesticated species that dates from before the origin of agriculture when human populations were living as hunter-gatherers (e.g. Germonpré et al. 2009, 2015, 2018; Thalmann et al. 2013; Freedman and Wayne 2017). Morphological and genetic analyses have shown that dogs descent from an extinct Eurasian Pleistocene wolf population or possibly several populations (e.g. Germonpré et al. 2009; Thalmann et al. 2013; Skoglund et al. 2015; Frantz et al. 2016). Although the dogs' ancestor is now known, many questions remain, such as how the first dogs could have participated in the daily life of their owners (Losey et al. 2018).

In this contribution, we first summarize two models on the origin of the dog; then we detail two canid morphotypes from the Upper Palaeolithic; next, we look to the Upper Palaeolithic sites that have evidence for the presence of incipient dogs. After that, we review ethnographic sources for dog-related practices among Northern societies and whether and how these could enhance differential access to resources and influence social status distinctions. Subsequently, we discuss what could have been the roles of early dogs in some Upper Palaeolithic societies. Finally, we propose a tentatively narrative on how the contributions of Palaeolithic dogs could have affected differential wealth and influenced social distinction among past men and women.

The domestic dog and its origin

According to Gompper (2014: 10) '…the dog can be defined as a domestic animal based on some combination of human manipulation of their reproduction, human selection on their genotypes or phenotypes, their commensal interactions with humans, and their role in the culture of humans.'

Pleistocene wolves are the single ancestors of dogs (Thalmann & Perri 2018). We must therefore study Palaeolithic Eurasia to learn about the first dogs. Although the ethnographic record from the circumpolar North, as defined by Anderson (2017: 134), cannot be used as a direct basis for a comparison with Palaeolithic Eurasia, it can help to envisage how Upper Palaeolithic humans and animals regarded each other and interacted (cf. Robert-Lamblin 2001; Germonpré & Hämäläinen 2007; Sharp & Sharp 2015) and what forms of social life were possible under the conditions of a foraging mode of subsistence during the Upper Palaeolithic (cf. Artemova 2016).

Several hypotheses have been proposed to explain the initial steps in the domestication process of the wolf (see Germonpré et al. 2018 and references herein). According to Stépanoff & Vigne (2018), the beginning of the domestication process was related to the concept of seeing living animals as co-operating partners instead of treating the animals as material. We favour a human-initiated model in which wolf pups were adopted. Wolf denning (culling or capturing of wolf pups at dens during spring) is traditional known to be practiced in order to reduce interspecific competition for prey (Farnell 2005) or to protect herds of domestic ungulates (Lescurieux 2007; Charlier 2015). Possibly, a comparable tradition existed in some regions of Eurasia during the Upper Palaeolithic. Captive wolf pups would then be available to be raised at the Upper Palaeolithic camps for several motives and likely some pups, the most docile (cf. Pierotti & Fogg 2017: 222) and less fearful ones, could have survived until adulthood and reproduced, permitting a new selection on every next generation leading ultimately to Palaeolithic dogs (Germonpré et al. 2018). This suggests some acknowledgment of the recognition of emotional inequality among the canid puppies, and such a selection behaviour by humans (affecting the captive canids) may tell us something about the emotional behaviour of humans regarding other human and non-human persons (cf. Losey et al. 2011). These domestic canids can but need not be the direct ancestors of recent dogs.

The self-domestication model proposed that some wolves adapted to the human niche by scavenging on human waste dumps at postglacial permanent settlements (Coppinger & Coppinger 2001). As it is now certain that the first dogs were already living during the Pleistocene, the revised model states that wolves adapted to the human niche by feeding on garbage dumps or stored food at Upper Palaeolithic sites. Those wolves that were not fearful or aggressive adapted to the human niche and dogs evolved gradually from this subpopulation (Zeder 2012; Larson & Burger 2013; Morey & Jeger 2015). Interesting to note in this context is that in North America First Nations hunters regularly left at the kill sites parts of the game for the wolves, coyotes or foxes (Wilson 1924; Tanner 1979; Brightman 2002; Sharp & Sharp 2015) out of respect (Pierotti & Fogg 2017) or, as noted in the ethnographic record of Northern Eurasia, as counter offerings of meat to be presented to a landscape master (Anderson 2017) or for the raven who guided the hunter towards the game (Shirokogoroff 1935). At the kill sites, the contacts and interactions between Pleistocene wolves and Palaeolithic hunters were in all likelihood very limited (Germonpré et al. 2018). Furthermore, Pleistocene progenitor wolf(ves) populations could only have developed in a separate ecotype when anthropogenic refuse would have been highly predictable and abundant. This was likely not the case during the Late Pleistocene (Lupo 2019). Additional critic on the self-domestication model is related to the limited accessibility of stored food and garbage and to the behaviour of habituated wolves (Koler-Matznick 2002; Germonpré et al. 2018).

In Germonpré et al. (2018) we used the scheme provided by Sigaut (1980) on domestication to explore the diversity of the relationships between humans and large canids and highlighted the importance of a 'ritualized socialization between humans and wolves' (Stépanoff & Vigne 2018: 11). Sigaut (1980) distinguishes four main types of contributions that a wild or domestic animal can provide: behavioural contributions, energy, corporal products and signs. Also, in this chapter, we organize our survey on an adapted scheme based on Sigaut (1980). We do not want to imply with this practical scheme that during the Upper Palaeolithic the relationship between humans and their domestic canids was hierarchical; on the contrary, we wish to underline the multi-layered dimensions of this ancient companionship (cf. Anderson 2017) and to highlight that dogs played a number of different roles (cf. Hayden 2014).

Palaeolithic dogs in Upper Palaeolithic sites

We have described two morphotypes of fossil canids in the Late Pleistocene (Germonpré et al. 2009, 2012, 2015, 2017a). The Pleistocene wolf morphotype is similar in size and shape to the recent wild wolves from northern Eurasia although the snout of this fossil morphotype is on average longer and wider than the muzzle of the recent Northern wolves in our data sets. The Palaeolithic dog morphotype has a unique morphology that falls outside the size and shape variability of Pleistocene and recent Northern wolves (Galeta et al. 2020; Germonpré et al. 2009, 2012, 2015a, 2017a) (Fig. 11.1). This morphotype has a smaller skull size and a shortened snout with a proportionally wide palate and a shorter and higher mandible compared to the wild type (Germonpré et al. 2015, 2017a), features related to the domestication syndrome (cf. Wilkins et al. 2014; Morey & Jeger 2015; Sanchez-Villagra et al. 2016; Wilkins 2017). Moreover, the skulls and mandibles of Palaeolithic dogs differ from those of recent Northern indigenous dogs (Germonpré et al. 2017a). Unfortunately, postcranial skeletal elements associated with skulls or lower jaws from Palaeolithic dogs are very rare. As the mean total lengths of skull and lower jaw of Palaeolithic dogs are significantly smaller than the corresponding mean lengths of Northern wolves (Germonpré et al. 2015a: tab. 4; Germonpré et al. 2017b: tabs. 5, 7), we propose that the mean lengths and widths of the long bones are probably smaller in the Palaeolithic dog morphotype than the mean values in the Pleistocene wolf morphotype. Long bones from large canids have been described as 'dog-like in size' when at least one of their measurements falls inside the observed range of the recent Northern dogs and is smaller than the corresponding lower limit of the observed ranges in Northern wolves (Germonpré & Sablin 2017; Germonpré et al. 2017b). It is possible that the 'dog-like in size' canids could be female Palaeolithic dogs.

European Palaeolithic dogs and 'dog-like in size' canids have been reported from early and middle Upper Palaeolithic sites from Europe above 45° latitude. So far, their remains seem to be absent in natural sites and in Middle Palaeolithic sites. Their presence has been attested in following Aurignacian and Gravettian European sites, dating from before the Last Glacial Maximum (LGM: *c*. 26.5 to 19 ka (Clark et al. 2009)): Goyet (50°N), Předmostí (49°N) (Fig. 11.2), Kostenki-1/I (51°N), Kostenki-8/I and Kostenki-8/II (51°N), Kostenki-11/Ia (51°N), Kostenki-12/I (51°N), Kostenki-14/III (51°N) and Kostenki-21 (51°N) (Germonpré et al. 2009, 2012, 2015; Camarós et al. 2016; Germonpré & Sablin 2017; Reynolds et al. 2019). In addition, a skull from an incipient dog has been recovered from the Razboinychya cave

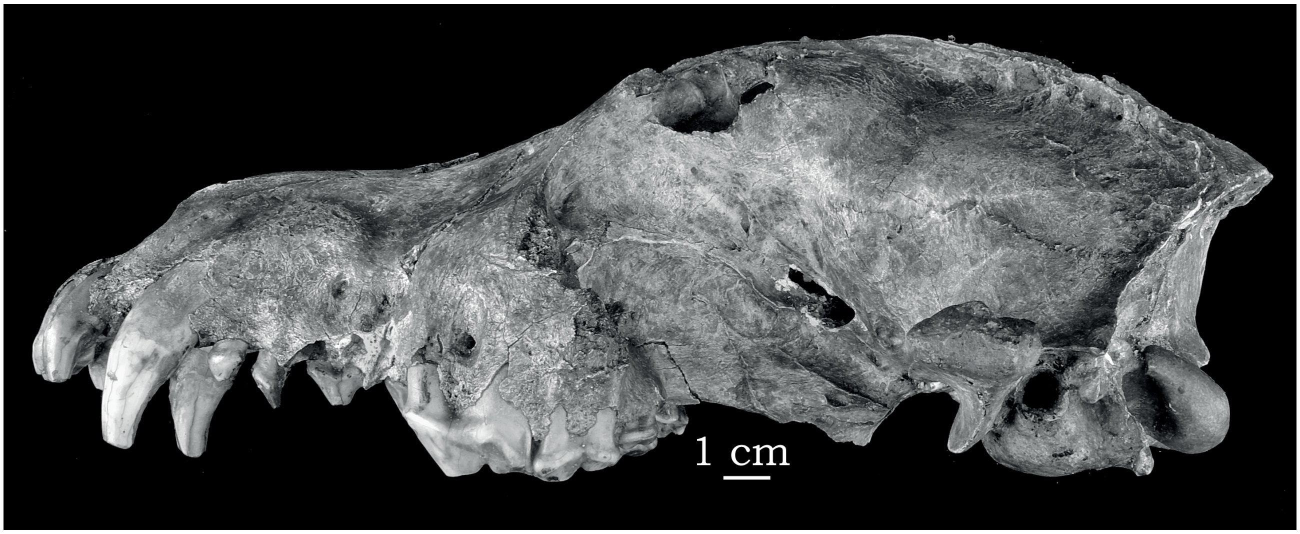

Figure 11.1. *Lateral view of the Pleistocene wolf skull (total skull length: 261 mm) from the Trou des Nutons cave, Belgium. Photograph Royal Belgian Institute of Natural Sciences.*

Figure 11.2. *Oblique view of a Palaeolithic dog skull (total skull length: 232 mm) from the Gravettian Předmostí site, Czech Republic, with a fragment of a flat bone inserted between the front teeth. Photograph Mietje Germonpré; skull from the collections of the Moravian Museum, Brno, Czech Republic.*

(51°N), a natural site in southern Siberia (Ovodov et al. 2011) and several canid skulls and lower jaws, possibly related to an early stage of domestication, were found at the middle Upper Palaeolithic Yana site (71°N) in northern Yakutia (Nikolskiy et al. 2018). However, the description of all these skeletal remains as from incipient dogs is not unequivocally accepted (e.g. Crockford & Kuzmin 2012; Morey 2014; Boudadi-Maligne & Escarguel 2014). Nevertheless, recent genetic research brought to light that the divergence between the ancestors of the recent dogs and recent wolves is very ancient and that the first steps of this domestication process likely can be situated in a time frame between 20,000 and 40,000 years ago (Thalmann et al. 2013; Skoglund et al. 2015; Botigué et al. 2017; Thalmann & Perri 2018). Remains from Palaeolithic dogs are more plentiful known from late Upper Palaeolithic European sites in Spain (Vigne 2005), France (Pionnier-Capitan et al. 2011; Boudadi-Maligne et al. 2012), Germany (Nobis 1986), Switzerland (Napierala & Uerpmann 2010), Ukraine (Pidoplichko 1998; Germonpré et al. 2009), European Russia (Sablin & Khlopachev 2002) and Siberia and the Far East (Birula 1929; Pavlow 1930; Dikov 1996; Losey et al. 2013; Germonpré et al. 2017a).

The above implies that already starting from the Aurignacian the Palaeolithic dog morphotype is associated with some Upper Palaeolithic societies. Interesting to add is that several Upper Palaeolithic sites with Palaeolithic dogs or 'dog-like in size' canids (e.g. Goyet, Předmostí, Kostenki-1/I, Eliseevichi) are characterized by the presence of male burials and/or female humanoid figurines (Pettitt 2018) and/or by direct (e.g. Praslov 2000) or indirect evidence (e.g. Germonpré et al. 2007; Shipman 2015; Germonpré & Sablin 2017; Wißing et al. 2019) of mammoth hunting. In a number of these sites, dating from the Gravettian and Epigravettian, specialization in bead and blade production, specialized exploitation of fur bearers and procurement of exotic materials, and/or architectural constructions made of mammoth skeletal elements suggest hierarchically organized societies with social differentiation (Soffer 1985). Other evidence of social differentiation exists in the European Upper Palaeolithic: the specialized knowledge related to the realism in Palaeolithic figurations shown in Upper Palaeolithic caves hints at inequalities of specialization and could imply a hierarchy of statuses within groups (Guy this volume).

The utility of indigenous dogs for Northern people

What evidence exists that dogs in hunter-gatherer and small-scale societies could enhance differential access to resources and influence social status distinctions that could vary between embodied, relational and material types of inequality? Mattison et al. (2016: 185) define inequality as 'differential access to power or resources, with persistent differences often resulting from hereditary privileges or formal position'. Kelly (1995) emphasizes that social inequality is inseparable from gender inequality. According to Borgerhoff-Mulder and collaborators (2009, 2011), inequality is associated with cross-generational wealth transmission among families. They define different types of wealth: embodied wealth that includes body weight, reproductive success, practical skills, productive knowledge; material wealth that includes land, livestock, household goods; and relational wealth that includes social ties in networks and symbolic goods. Although the transmission of wealth to offspring is modest in hunter-gatherers, children born in better-off families have, nevertheless, a bigger chance of becoming affluent (Borgerhoff-Mulder et al. 2009). Chaudhary et al. (2016) showed that relational wealth is heritable among recent hunter-gatherers and that cooperative alliances can be passed on inter-generationally. Hunter-gatherers societies can be subdivided in those with considerable residential mobility with their members living in smaller groups and those with larger groups residing year-round or seasonally in villages (Kelly 1995; Smith et al. 2010). Smaller hunter-gatherer societies are often considered to be more egalitarian (Kelly 1995). Egalitarian societies are described by Artemova (2016: 14) as 'a society in which all the people have equal access to all material and spiritual values of their culture and have equal personal freedom and equal opportunities for decision-making.' Larger hunter-gatherer groups live, in general, in larger settlements; their reduced residential mobility is strongly related to spatiotemporal resource distribution that can lead to food storage and material wealth accumulation (cf. Sahlins 1972) and can be linked to important socio-political changes (Kelly 1995). In addition to wealth, exclusive and ritual knowledge is a type of capital that can influence an individual's place in the social life of his community, can be inherited and become a source of inequality (Smith et al. 2010; Artemova 2016).

We want to examine in this study whether dogs, which are part of the wealth of their owners, could influence cross-generational transmission of different aspects of wealth and could serve fitness interests of men and women differently. According to Hawkes et al. (2018), women have more interest in managing off-springs quality-quantity trade-offs by provisioning their children directly. In contrast, men share meat from large game they killed as public goods (Hawkes et al. 2018) and display in this way their generosity and commitment (Gurven & von Rueden 2006; Stibbard-Hawkes 2019). This latter type of meat sharing compensates the unpredictability of the hunting of large game, benefits all and provides the suppliers highly valued reputations and marks them as distinctly esteemed social partners (Hawkes et al. 2018; Stibbard-Hawkes 2019), thus contributing to the relational and embodied wealth of the hunters.

We integrate here a non-exhaustive list on the utilities of indigenous dogs, based on the circumpolar ethnographic literature, of the four main types of 'products' (behaviour, energy, body, sign), as proposed by Sigaut (1980) that dogs can contribute to their male and/or female owners. We use subsequently the term 'role' or 'contribution' instead of the term 'product' and we add a fifth type: the prestige role of dogs (Table 11.1).

A first type of role is related to the behaviour of dogs. Several subtypes are proposed by Sigaut (1980) (Table 11.1).

(i) food-related: Dogs can function as hunting aides because they can diminish search costs, augment prey encounter rates, drive prey into locations where they can be killed, keep dangerous animals at bay, trail wounded prey and locate carcasses of perished animals, all factors that improve hunting success (Balikci 1989; Abe 2005; Grøn & Turov 2007; Koster 2008; Vaté 2013; Perri 2016; Lupo 2017; Samar and Kim 2017; Roberts 2017; Oehler 2018) (Table 11.1). In hunter-gatherer societies men, in general, hunt large game that is subsequently distributed as public good; women occasionally hunt small game, which is mainly used for family provision (e.g. Blieg Bird & Bird 2008; Sharp & Sharp 2015; Hawkes et al. 2018). In Siberia, skilful hunting dogs know how to bark in different ways to inform their master about different kinds of animals and they are reputed to tell in the dreams of their owners where game can be found (Brandišauskas 2017).

However, there are downside effects of hunting with canines. In Neotropic small-scale societies, dogs can spend too much time in chasing unwanted prey species and increase encounters with predatory felines (Koster 2008a, b). In Tropical and Neotropical small-scale societies, hunting dogs die young (≤ 4 years old) (Koster & Tankersley 2012; Lupo 2017). Furthermore, it seems that the uses of dogs for hunting was rather limited in northern North America at contact times (McCormack 2018). The Hidatsa dogs, for instance, did not help in hunting (Wilson 1924). The dogs of the Mongolians nomads do not assist in hunting because of the risk that they would turn from guardians to predators (Charlier 2013).

(ii) social aspects: In the western Subarctic during pre-contact times, women managed the dogs and cared for the puppies (McCormack 2018); women from northeastern North American cultures sometimes breastfed puppies (Roberts 2017). The Iňupiaq people held dogs for company (Wilders 1976) and little girls treated the puppies as babies (Spencer 1959). In Siberia, the Chuckhi children (Vaté 2013) and the Oka-Soiot children (Oehler 2018) play with and socialize dog puppies, a kind of dual apprenticeship (Vaté 2013). In contrast, Mongolian nomads are rude to their dogs in order to make the animals tougher; children may not play with dogs, not even with puppies (Charlier 2015).

(iii) defence: In various nomadic societies of Central and Northern Asia, the prime assignment of the dog is to guard the camp and the people. Watch-dogs, often tethered, warn about approaching wolves, bears and strangers and their barking has a dissuasive function (Shirokogoroff 1929; Lescureux 2007; Vaté 2013; Klokov & Davydov 2018; Oehler 2018). At Orochen campsites, dogs are tied up in a circle, so they can be easily observed (Brandišauskas 2017). According to the Chuckhi reindeer herders, people should not walk alone in the tundra without a dog (Van Deusen 1999). When people leave the camp to gather berries and mushrooms, a dog is taken along (Vaté 2013; Klokov & Davydov 2018). In Mongolia, dogs are not allowed inside the dwellings. A dog must be a good guardian and therefore must be ferocious (Charlier 2015). In fact, a dog should be docile with its owners but aggressive towards strangers, although they are taught not to be over-aggressive (Lugli 2016). Also in North America dogs are used for protection at the camps (Wilson 1924; Nelson 1983).

In the circumpolar North, dogs were also important as guardians against evil spirits (Vaté 2013; Laugrand & Oosten 2015; Samar & Kim 2017).

It should be noted that the protection from dangerous predators is a reciprocal interaction. In the Gwich'in camps, the dogs were tethered. In this way they were kept nearby and did not wander off and could so be protected from being preyed upon by wolves (Anderson et al. 2017). Also in the Russian North dogs are protected from predators by living in the human society (Klokov & Davydov 2018).

A second type of role of dogs relates to energy (Table 11.1). Dogs often helped their owners with the transport of goods as pack animals. In this way, they carried two large bags on the left and right side of their back filled with supplies or meat from kills (Nelson 1983;

Table 11.1. *Comparison of dog roles (cf. Sigaut 1980) based on the ethnographic and archaeozoological (Upper Palaeolithic) record (non-exhaustive list). Key: l – living; d – dead; + – clear evidence; (+) – likely; ? – possible.*

		Recent northern dog ethnographic record	Palaeolithic dog archaeozoological (UP) record
Behaviour	*(i) food-related*		
	hunting aide (l)	+	(+)
		Balikci (1989), Abe (2005), Grøn & Turov (2007), Koster (2008), Vaté (2013), Perri (2016), Brandišauskas (2017), Lupo (2017), Samar & Kim (2017), Roberts (2017), Oehler (2018)	Morey (2010), Perri et al. (2015), Shipman (2015), Perri (2016), Lupo (2017)
	hunting aide by dreaming (l)	+	?
		Brandišauskas (2017)	
	(ii) social		
	managing/handling (l)	+	(+)
		Wilson (1924), McCormack (2018)	
	compagnon/pet (l)	+	+
		Spencer (1959), Wilders (1976), Oswalt (1979), Vaté (2013), Oehler (2018)	Janssens et al. (2018)
	(iii) defence		
	guarding/sentinel (l)	+	+
		Wilson (1924), Shirokogoroff (1929), Nelson (1983), Lescureux (2007), Vaté (2013), Loovers (2015), Charlier (2015), Lugli (2016), Brandišauskas (2017), Klokov & Davydov (2018), Oehler (2018)	Zapata et al. (2016)
	berry picking aide (l)	+	(+)
		Vaté (2013), Klokov & Davydov (2018)	
	guarding against evil spirits (l)	+	?
		Vaté (2013), Laugrand & Oosten (2015), Samar & Kim (2017)	
	dogs protected by humans (l)	+	(+)
		Laugrand & Oosten (2015), Anderson et al. (2017), Klokov & Davydov (2018)	
Energy	**transport/pack animal (l)**	+	(+)
		Wilson (1924), Spencer (1959), Prokof'yeva et al. (1964), Black (1973), Nelson (1983), Balikci (1989), Speth et al. (2013), Loovers (2015), Sharp & Sharp (2015), McCormack (2018)	Germonpré et al. (2016), Germonpré (unpublished)
	dog races (l)	+	?
		Ivanov, Levin & Smolyak (1964), Ivanov, Smolyak & Levin (1964), Samar & Kim (2017)	
Body	**fur (d)**	+	(+)
		Bogoras (1904), Black (1973), Balikci (1989), Issenman (1997)	
	wool (l)	+	(+)
		Teit (1900), Sokolowa (1982), Solazzo et al. (2011), Hayden (2014)	
	meat (d)	+	+
		Spencer (1959), Black (1973), Brightman (2002), Laugrand & Oosten (2015), Charlier (2015), Roberts (2017)	Pionnier-Capitan et al. (2011)
	fat (d)	+	(+)
		Klokov & Davydov (2018)	
	long bones (d)	+	+
		Teit (1900)	Germonpré et al. (2017b)
	saliva (l)	+	?
		Rasmussen (1932)	

Table 11.1 *(cont.)*.

		Recent northern dog ethnographic record	Palaeolithic dog archaeozoological (UP) record
Sign	**visual display/amulet (dentition, bones) (d)**	+	+
		Rasmussen (1932), Black (1973), Samar (2009)	Gvozdover (1995), Germonpré et al. (2012)
	sacrifice/ritual (body) (d)	+	(+)
		Henry (1809), Jochelson (1905), Black (1973), Yamada (2001), Samar & Kim (2017)	
	symbolic meaning colour red (d)	+	+
		Vasilev (1948), Laestadius (2002), Samar (2009)	Street et al. (2015), Reynolds et al. (2019)
	spiritual guide/mediator (body) (d)	+	(+)
		Teit (1900), Jochelson (1905), Kretschmar (1938), Popov & Dolgikh (1964), Black (1973), Schwartz (1997), Yamada (2001), McCormack (2018)	Street et al. (2015)
	ritual (head/skull) (d)	+	+
		Black (1973), Akino (1999), Lugli (2016), Oehler (2018)	Polikarpovich (1968), Sablin & Khlopachev (2003), Germonpré et al. (2009, 2012, 2017b)
Prestige	**status (l)**	+	(+)
		Teit (1900), Ivanov et al. (1964), Black (1973), Oswalt (1979), Nelson (1983), Hayden & Schulting (1997), Koster (2012), Hayden (2014), Prentiss et al. (2014), Oehler (2018)	
	being fed/controlled diet (l)	+	+
		Shirokogoroff (1929), Prokof'yeva et al. (1964), Black (1973), Sharp (1976), Sokolowa (1982), Nelson (1983), Balikci (1989), Brightman (2002), Abe (2005), Laugrand & Oosten (2015), Sharp & Sharp (2015), Lugli (2016)	Bocherens et al. (2005)
	cleaning human excrements (l)	+	(+)
		Shirokogoroff (1929), Brightman (2002), Willerslev (2007), Charlier (2015), Laugrand & Oosten (2015)	
	fish based diet (l)	+	?
		Prokof'yeva et al. (1964), Black (1973), Sokolowa (1982), Brightman (2002)	
	dog sharing (l)	+	(+)
		Spencer (1959), Stepanova et al. (1964), Wilders (1976), Balikci (1989), Brandišauskas (2017), Oehler (2018)	

Balikci 1989). Estimates, based on ethnographic data from North America, for the weight of a dog back pack range from 15 to 20 kg (Speth et al. 2013; Loovers, pers. comm. 2016). In many hunter-gatherer societies, it is the women that have the burden of carrying goods and looking after transport (Wilson 1924; Sahlins 1972; McCormack 2018; Loovers 2015), so pack dogs, which haul fire wood, water and belongings, can ensure that women have to carry less or can help to move extra possessions. Moreover, pack dogs have been shown to permit long hunting expeditions since hunters could stay out overnight thanks to the supplies carried by the dogs (Sharp & Sharp 2015).

In Siberia, among the Nivkh, Orochen and Ulcha, dog races were held during the celebration of the bear festival (Ivanov, Levin & Smolyak 1964; Ivanov, Smolyak & Levin 1964; Samar & Kim 2017) (Table 11.1). There is no hard evidence for the existence of sleds in the Upper Palaeolithic; the oldest unambiguous remains of sleds date from the Early Holocene (e.g. Pitulko & Kasparov 1996), so the specifics of dog teams will not be detailed here. Nevertheless, it cannot be excluded that sled dogs already existed by the end of the Pleistocene (Pitulko & Kasparov 2017). Interesting to add here is that sled dogs are not regularly used as watchdogs since they scarcely bark (Strecker 2018).

Herding performed by dogs is not discussed here since it has no bearing on the utility of Palaeolithic dogs.

A third type of dog contribution is related to corporal products and includes the utilization of dog skin and consumption of dog meat (Table 11.1). Circumpolar women use wolverine, wolf, fox and dog skins for decorative borders, to make trousers and to apply ruffs around the hood or sleeves of parkas, because the long and uneven guard hairs of these carnivores repel frost (Balikci 1989; Issenman 1997). The Nivkh used dog skin to line cradles and wrap babies (Black 1973). The Koyukon did not use dog skin because it has a strong smell; furthermore, since dogs are close to people their fur would revive the lost affection with the domestic animal (Nelson 1983). Northwest Coast Indians bred special wool dogs, the wool of which was used for weaving prestigious blankets and capes (Teit 1900; Solazzo et al. 2011; Hayden 2014). Also, in Siberia the wool of dogs was used (Sokolowa 1982).

In times of starvation, the Inuit ate dogs (Laugrand & Oosten 2015). It seems that the Inland Iňupiaq people consumed dogs, especially puppies, more regularly (Spencer 1959). For the Rock Cree, dog meat was an emergency food (Brightman 2002). The societies from northeastern North America ate their dogs in times of scarcity and during ceremonies (Roberts 2017). For the Chipewyan, the dog is inedible due to the fact that dogs eat anything (Sharp 1976). The Nivkh consumed dog meat in a ritual context (Black 1973). Mongolian nomads sometimes taste dog meat as a medicine (Charlier 2015). In the Russian North, dog fat can be used as a medicine for lung diseases (Klokov & Davydov 2018).

The Mid-Fraser peoples made fish hooks from dog bones (Teit 1900). Among the Copper Inuit, the saliva of a dog was considered as a medicine for certain illnesses (Rasmussen 1932).

The fourth role of dogs corresponds to signs. However, in contrast with Sigaut (1980), we propose to limit this type not only to the complete body of the animal, but include also blood and skeletal parts, like teeth and skulls. Therefore, some functions grouped under this type could overlap with bodily functions. The bones, dentition and blood of dead dogs can have a special meaning. For the Copper Inuit, the wearer of an amulet made of the bones of a dog will be revenged by the soul of that dog, if murdered (Rasmussen 1932). Among the Nivkh, infertile women and women desiring another child wore dog tooth amulets (Black 1973). The Ulchi hung up dog canines as protection above the bed of a new-born child (Samar 2009). The above examples hint that body parts of dogs had a protective role in Northern societies.

Several peoples of East Asia such as the Nivkh, Nanai and Ainu raised a bear cub, captured after its mother was killed, in order to have a bear feast when it had grown up (e.g. Batchelor 1909; Kitagawa 1961; Yamada 2001; Willerslev et al. 2015). When the animal became adult, it was killed during a sending-away ceremony. The Nivkh men sacrificed dogs so that the souls of these animals could guide the soul of the bear killed at the festival to the place where the Master of the Mountain/Forest, who is the owner of the game, dwells (Yamada 2001; Black 1973). The sacrificed dogs' heads were hung on trees around the location of the ritual deposition of the bear skull and bones (Black 1973). Also, the Oroks ritually killed dogs as a part of their bear festival (Samar & Kim 2017). In Northern small-scale societies, people often adorned the killed bear with the colour red (ochre, alder bark juice, blood). Such anointment was not limited to the bear; sometimes the hunters, their wives, the guests and the dogs present at the bear hunt, killing or feast were daubed with the colour red (for details see Germonpré & Hämäläinen 2007). The Saami put alder bark juice on their dogs during the bear hunt (Laestadius 2002). The Nanai placed, during a bear feast, wood shavings smeared with blood of a dog through a hole inside the skull of the bear (Samar 2009). Before the ritual deposition of the cleaned bear remains, the Orochi covered the bear skull with dog blood (Vasilev 1948).

The ethnographic literature of the circumpolar North abounds with beliefs that human souls need the souls of dogs to accompany them (e.g. Kretschmar 1938; Schwartz 1997). In Northwest northern America, when their master died, dogs were sacrificed by men (cf. McCormack 2018) and their carcasses were hung from poles near the grave (Teit 1900). Also, the Siberian Koryak had this tradition (Jochelson 1905). During Ket and Nivkh funerals, men sacrificed dogs, often by strangulation, so that the dog souls could guide the human soul to the after-world; the meat of the killed dogs was eaten (Popov & Dolgikh 1964; Black 1973).

The dogs themselves can receive a specific treatment upon death. Mongolian nomadic pastoralists, before displacing their dead dogs, put a piece of fat, butter or some milk in their mouth; their tail is chopped of and put under the snout during burial (Lugli 2016). The Oka-Soiot hunters place also butter or something delicious in the dog's mouth upon burial, to feed it for the road (Oehler 2018). Some Ainu had a dog-sending ceremony for dead dogs; the remains were deposited together with offerings of among others dried fish; a hole in the head permitted the spirit of the deceased dog to pass through (Akino 1999) (Table 11.1). In the North, not only dogs, but also wild canids could be given food after they died. Foxen and wolves, after being trapped and skinned, could receive a specific treatment. The Koyukon people placed a bone between the front teeth of a skinned fox and put a piece of dried fish in the mouth of a skinned wolf (Nelson 1983).

In North America and Siberia, dogs were also sacrificed by men as an offering to calm down bad weather or as an offer to the Supreme Being (Henry 1809; Jochelson 1905; Black 1973).

We add here a fifth type of dog contribution: the prestige role of dogs (Table 11.1). Keeping dogs is a costly affair. In societies that use dogs in hauling, dogs are more frequently provisioned than among those societies that utilize dogs in non-hauling activities (Lupo 2019). A detailed account of how frequently dogs are being fed and with what resources as reported in the ethnographic record is detailed in Lupo (2019, Appendix 2). According to Chikachev (2004, in Klokov & Davydov 2018), a dog team of 10 sled dogs consumed almost 4 tons of fish each year. Families of the Northwest coast of North America fed each of their dogs about a kilogram of salmon every day (Hewes 1973). Dogs living in northern climates need adequate nourishment to maintain thermal neutrality in cold weather (Lupo 2019). Not all hunter-gatherer families have dogs, since dogs required a lot of food. In general, hunters have one, two or three (Wilders 1976; Loovers 2015; Oehler 2018; Lupo 2019). Therefore, dog ownership could indicate wealth and status and be related to increasing social inequality among hunter-gatherers (Prentiss et al. 2014). In North America and Siberia, hunter-gatherers also kept wild-born animals, such as eagles, crows, foxes, bears, wolves, deer and bison, as pets (e.g. Shirokogiroff 1935; Heizer & Hewes 1940). According to Hayden (2014), domestic and wild-born pets acquire a lot of food; raising them demands a lot of resources and only wealthy families can afford to do so. The keeping of tamed and domestic animals can thus be part of a form of status display (Hayden 2014). The dog was for the Nivkh an important status symbol (Black 1973). A high number of dogs in a family was a sign of wealth. As much as 40 dogs were kept; they were fed fish and seal fat (Ivanov, Levin & Smolyak 1964). Well-trained dogs could contribute to the hunting success of their master and increase his social status. The Koyukon people bestow prestige on the owners of well-trained dogs (Nelson 1983). The Oka-Soiot hunters lent their talented hunting dogs without expecting a share of the game (Oehler 2018). Dogs were killed as a sacrifice upon the death of their master, displaying individual wealth (Teit 1900; Hayden & Schulting 1997).

Although dogs are often considered to have a similar diet as their owners (e.g. Guiry 2013), the ethnographic record from the circumpolar North shows that dogs are regularly fed selection of undesirable food that is unpopular with humans, like reindeer and moose longs and stomachs (Nelson 1983; Sharp & Sharp 2015), reindeer meat with a lot of parasites (Sharp 1976), unpalatable glands (Balicki 1989), worn-out clothing made from the skin of prey animals (Laugrand & Oosten 2015), cooked old meat, hooves, intestines, periosteum and blood (Abe 2005) or family's leftovers (Lugli 2016); dogs could, in this way, contribute to cleaning waste (Shirokogoroff 1929). Dogs eat also human excrements (Shirokogoroff 1929; Brightman 2002; Willerslev 2007; Charlier 2015, Laugrand & Oosten 2015). Furthermore, the composition of the dog food varies seasonally (Oehler 2018). However, dogs cannot live long on garbage; their diet must therefore be supplemented (Lupo 2017). Especially, dogs used for hauling require a diet with high levels of fat and protein (Lupo 2019). Often in hunter-gatherer societies, fish and hare are considered to be the most appropriate dog food (Prokof'yeva et al. 1964; Black 1973, Sokolowa 1982; Brightman 2002).

People without dogs were considered to be poor and depended on others to travel (Spencer 1959). The village grouped its dogs if there was a need to travel by dog team (Wilders 1976). When the Netsilik needed more dogs for a long journey they borrowed them from close relatives (Balikci 1989). The Yukagirs households combined their dogs to transport their belongings (Stepanova et al. 1964).

In Greenland, poor people wore parkas made from dog skin, a distinction that, according to Oswalt (1979), indicated some inequality in the society. Possibly, poor people used for this the skins of ill-fed, free-roaming dogs, while the fur of the more prestigious dogs could have been used for better clothing (Haynes pers. comm. 2018).

Indigenious dogs and social inequality

It seems that, in general, northern people had at the most a few dogs per household. Dogs could guard their owners, act as companions and hunting aides, assist with body and soul in feasts and ceremonies, be used as fur, tool and food source and play a prestige role. People who had dogs could travel more easily. According to McCormack (2018), in Athapaskan and Algonquian societies, the use of dogs for hunting was limited and dogs were typically used for packing and hauling (see also Lupo 2019). In some groups the women took care of the dogs, in others, men handled dogs, children socialized puppies and were socialized by them. Generally, there is lack of evidence for eating dog on a regular basis. It seems that trained dogs were not sold nor traded, although dogs, mostly puppies, were given away or exchanged by women (Wilson 1924; Shirokogoroff 1929; Spencer 1959). From the above, it is clear that dogs played important socio-economic, emotional and ritual roles in Northern societies. In some parts of the North, dogs held an ambiguous position. Talented, good-hunting dogs were respected but dogs were also considered dirty because of their feeding on human excrements, their sexual practices and their smell (Brightman 2002; Willerslev 2007). Nevertheless, dogs could signal prestige and status since especially wealthier households could afford keeping many dogs (Prentiss et al. 2014). Furthermore, a positive correlation exists between highly ranked male hunters and highly ranked dogs in small-scale societies (Koster & Tankersley 2012). Orochen hunting teams invite a lucky hunter to make his trained dogs available for the whole group; such sharing strengthens the friendship among hunters (Brandišauskas 2017). Dogs sometimes were shared among people from a same settlement or nearby settlements to help those with less dogs with hunting or transport, without expecting a return (Shirokogoroff 1929; Spencer 1959; Stepanova et al. 1964; Wilders 1976; Oehler 2018). An advantage of such lending could be that the owner must not feed the dog as long as the animal is with the borrower. An obvious gain is that lending dogs strengthens social relations and friendships (cf. lending of donkeys: Marshall & Weissbrod 2009) and could induce cooperative behaviour (Barclay 2013). So, talented dogs could add to relational forms of wealth of their owners. This type of wealth is less easily passed on to the next generation than material aspects of wealth (Smith et al. 2010) but can be transmitted nevertheless (Kelly 2010; Chaudhary et al. 2016). Dogs play an important part in rituals and it is possible that the executers of these rituals transmitted their privileged knowledge concerning dogs to the next generation (cf. Borgerhoff-Mulder et al., 2009). Such monopolized knowledge could contribute to trans-generational social differentiation (cf. Hayden 2008; Artemova 2016).

We propose here that dog husbandry signals material wealth and social status since dog feeding is very costly and competes with human food especially in those regions where food availability is seasonal (cf. Ingold 1980; Lupo 2019), but probably dog ownership does little to accumulate material wealth for households (cf. Russell 2012). In addition, we tentatively propose that dogs can contribute to aspects of the relational wealth of their male owners: talented dogs can increase the prestige of their masters by contributing to the hunting success of their masters and because they can be lent to help others with hunting. In addition, dogs permit longer journeys that could facilitate the acquirement of exotic goods and the enlargement of the network of their owners. Moreover, the important part dogs play in rituals could be linked to secluded knowledge. These are all benefits that can subsidize the relational and embodied wealth of male dog owners. Therefore, it is plausible that (talented) dogs attribute to social inequality and serve the fitness interests of their male masters. We cautiously suggest that dogs can augment the embodied wealth of their female owners through their role in transportation by reducing the physical stress their female masters must endure and through their defensive role at camp sites and berry and mushroom gathering localities by protecting their owners and her children from physical violence. In addition, the lending of dogs to help others with less dogs and the exchange or giving away of puppies could increase the relational wealth of female owners. Thus, likely dogs could influence social inequality and improve the health outcome of their female masters and children and thus increase the fitness interests of women with dogs.

The utility of Palaeolithic dogs for Upper Palaeolithic people

We want to consider whether Palaeolithic dogs could have enhanced differential access to resources, attributed to the accumulation of wealth and influenced the social inequality of their owners. Therefore, we revise the possible uses of the contributions that could have been delivered by Palaeolithic dogs (cf. Sigaut 1980), examine the registration of such dog contributions in the archaeozoological record from the European Upper Palaeolithic and compare these with data from the ethnographic literature (Table 11.1). The ethnographic evidence permits to conceptualize a set of predictive statements regarding relationships between the presence of dogs, the acquisition and maintenance of differential wealth and the probability that some forms of inequality could have emerged in Pleistocene Europe, before agriculture. From the ethnographic data we deduce that ownership of dogs, because of the feeding costs, confer status to their masters. Viable arguments, however, cannot be found for dogs having a causal role in the development of material wealth, although dog husbandry can reflect material wealth. On the other hand, talented hunting dogs, and maybe also the privileged knowledge concerning rituals involving dogs, could increase the relational wealth and serve the fitness interests of male dog owners. Pack and guard dogs could augment the embodied and relational wealth and enhance the fitness interests of their female masters. We conclude with a simplified narrative on the influence of dog ownership on different forms of wealth and social status during the Upper Palaeolithic.

The first type of role is related to the behaviour of Palaeolithic dogs and includes several subtypes (Table 11.1).

(i) food-related: Dogs play in many forager societies an important role as hunting aide. For detailed analyses concerning the use of Palaeolithic dogs for hunting, the reader is referred to Perri (2016) and Lupo (2017). The debate whether Palaeolithic dogs were already fellow hunters of Upper Palaeolithic hunter-gatherers is difficult to demonstrate (Morey 2010) and is not closed yet (Shipman 2015; Perri et al. 2015). However, if Palaeolithic dogs would have contributed to the hunting of large game, there should be evidence of intentionally feeding them and of efforts to promote their longevity (Lupo 2017).

(ii) social aspects: Remains of two dogs are associated with the double human burial of the Magdalenian Bonn-Oberkassel site in what is now Germany. One Magdalenian dog suffered from a fatal canine distemper infection. Several enamel hypoplasia lines on the dentition suggest that the dog was seriously ill when it was between five and six months old, it died when it was about seven months old (Janssens et al. 2018). Its masters must have been taken care of the pup, otherwise the animal would not have survived so long. The authors propose that the inferred supportive care was based on compassion or empathy and that the Bonn-Oberkassel dog could suggest an emotion-driven human-dog bond (Janssens et al. 2018). Alternatively, the supportive care was maybe motivated by the fact that its owners wanted to promote the pups' longevity because it was sired by or belonged to the litter of talented hunting dogs.

(iii) defence: It can be expected that the presence of Palaeolithic dogs at camp sites and at berry or mushroom gathering localities conveyed some selective advantage to the people. These palaeodogs could have been very useful as sentinels, by warning of the approach of predators or unfamiliar humans through vocalizations; this would have provided protection to the inhabitants of the camps and the gatherers collecting at a distance from the settlements, likely women and children.

The Gravettian Předmostí site in the Czech Republic, dated at *c*. 28,500 years ago (Germonpré et al. 2017b), is mostly beknown for its rich human assemblage, extracted from different burial contexts and composed mainly by remains from young people (Klíma 1991; Brůžek & Velemínská 2008). An isolated human pelvis, found outside the mass grave, shows a large puncture. Most likely, a sharp, pointed object perforated the pelvic bone and probably also the abdominal cavity and caused the violent death of this person (Klíma 1991). This evidence of interpersonal violence suggests that large Palaeolithic dogs could have been useful as guards at Předmostí to protect against physical assault. It appears, based on the cementochronology of the dentition of several species (Nývltová Fišáková 2013) and the extended and intensive occupations (Svoboda et al. 1994), that Předmostí was inhabited during all seasons. The mammal assemblage of Předmostí is dominated by mammoth remains, including mammoth calves ranging in age at death of a few days to several months old (cf. Musil 1968). Mammoth meat was likely a staple food of the inhabitants of the site (Oliva 1997; Bocherens et al. 2015). The processing of mammoth meat and fat must have been very time-consuming. The Palaeolithic dogs could have helped to protect the stored mammoth resources at the Předmostí site against plunderers (cf. Wengrow & Graeber 2018). In the first phases of the domestication process, it is likely that the Palaeolithic hunter-gatherers did not place a strong selective pressure on the canids that would have led to a body size reduction (Sablin & Khlopachev 2003; Pierotti & Fogg 2017). A recent study of Zapata et al. (2016) comparing a genome-wide association mapping for fear and aggression traits across dogs from diverse breeds with the genetic variation in extant wolf populations revealed that reduced fear and aggression alleles are more frequent in modern dog breeds than in wolves, consistent with a selection of reduced fear and aggression variants during the domestication process. In addition, the reduced fear/aggression allele is often in perfect linkage disequilibrium with the allele for increased-body size. This could suggest that a selection of less fearful/aggressive individuals accorded with animals with a large body size. Those large and less fearful/aggressive domestic canids probably were suitable for the protection against apex predators (Zapata et al. 2016), especially during the early and middle Upper Palaeolithic. The Palaeolithic dogs could have helped their masters to control local populations of large carnivores, such as cave hyenas and cave bears, which went extinct during the early and middle Upper Palaeolithic (Stiller et al. 2014; Stuart & Lister 2014), cave

> lions, which became locally extinct in Europe between approximately 30,000 years and 19,000 years ago (Stuart & Lister 2011) and Pleistocene wolves. In this way, life became safer for children (Germonpré et al. 2018) and competition for prey diminished (cf. Grøn & Turov 2007), possibly increasing the hunting success rate of the Upper Palaeolithic dog masters. Once apex predators like the cave hyena and cave lion became rare or extinct, selection of larger individuals would have been less useful (cf. Germonpré et al. 2009).

A second type of role of palaeodogs is related to energy (Table 11.1). According to Maier et al. (2016), Upper Palaeolithic hunter-gatherers living at higher latitudes, north of the timberline and in the zone of the continuous permafrost, had to adapt to a cold and dry climate in a treeless landscape and needed to travel long distances to satisfy their daily requirements. Palaeolithic dogs could potentially have been very suitable for the logistical and residential mobility of their people, helping with the transportation of gear, firewood, lithics, body parts of prey, etc. (Germonpré et al. 2017a).

It is interesting in this context that all early and middle Upper Palaeolithic sites where remains of Palaeolithic dogs and 'dog-like in size' canids are present north of timberline and in the zone of continuous permafrost at latitudes above 45°N. Pack dogs can permit long expeditions since hunters could stay out overnight thanks to the supplies carried by the dogs (cf. Sharp & Sharp 2015) and in this way, could make it easier for their masters to obtain information and non-local goods. Distinct skeletal evidence for the use of dogs as pack animals, sled-dogs or travois-pulling dogs could be anticipated in the archaeological record (Morey 2010). Deformed spinous processes found on vertebrae from prehistoric dogs have been proposed to result from carrying burdens on their back (e.g. Warren 2000), although diagnostic alternatives should be considered (Lawler et al. 2016). At the Gravettian Předmostí site, the limited presence of canid vertebrae affected by spondylosis deformans does not support an argument for the use of domestic canids as pack animals. Such inferences as pack dogs should be deduced from other skeletal elements, including analyses of entheses on long bones (Germonpré et al. 2016). In addition, the low incidence of spondylosis deformans at the Předmostí assemblage suggests that the large canids from this site did not become very old. Indeed, preliminary results from age estimations based on dental wear show that most large canids from Předmostí died when they were between four and six years old (Germonpré, unpublished data).

The oldest, undisputed remains of sleds date from the Early Holocene (e.g. Pitulko & Kasparov 1996). At the early Holocene Zhokov site in arctic Siberia, the presence of sled dogs suggests that their origin could date back from the end of the Pleistocene (Pitulko & Kasparov 2017). Moreover, a bone tool found at the late Palaeolithic Siberian Afontova Gora sites is reminiscent to toggles from sled dog harnesses (Pitulko & Kasparov 2017). Interesting to add here is that the mammal assemblages from the Afontova Gora sites contain remains from canids described as domestic dogs (Pawlow 1930; Germonpré & Sablin 2017a).

Corporal products of Palaeolithic dogs, the third type proposed by Sigaut (1980), could have converted advantages, such as fur for clothing, meat and fat for food, long bones and teeth as the raw material for the fabrication of tools (Table 11.1). The interest of Upper Palaeolithic people in bodily products from Palaeolithic dogs can be deduced from canid bones bearing marks of human manipulation. So far, human traces on canid remains from Palaeolithic dogs or 'dog-like in size' canids have not been observed that could be related to the recuperation of fur. However, it is worth mentioning here that several Upper Palaeolithic sites include important amounts of large canid bones that indicate the use of large canid pelts to tailor cold weather clothing (Collard et al. 2016; Wilczyński et al. 2015). One bone from the Gravettian Předmostí site, a tibia described as 'dog-like in size', formed likely a raw source and was probably cut as part of a *chaîne opératoire* of tool making (Germonpré et al. 2017b). At Předmostí, there is no clear evidence of dog meat consumption, although it is likely that Pleistocene wolves and 'wolf-like in size' canids were eaten occasionally (Germonpré et al. 2017b). Cynophagy was practiced at the late Upper Palaeolithic site of Pont-d'Ambon (France) (Pionnier-Capitan et al. 2011).

The fourth canid role is related to signs (Table 11.1). Specific human treatments of skeletal remains and the information that can be deduced from the unusual placement of these remains at several Upper Palaeolithic sites hint at the symbolic and ritual importance of certain species (Germonpré & Hämäläinen 2007; Livarda & Madgwick 2018). Human-modified teeth have been proposed to be exponents of the collective symbolic imagination (White 2007). The symbolic meaning of the colour red likely emerged very early, in the African Middle Stone age (Watts 2002; Hovers et al. 2003). Red ochre is often associated with Upper Palaeolithic human burials, female figurines and fossil bear remains, and has been related to rituals (e.g. Germonpré & Hämäläinen 2007; Svoboda 2008a; Pettitt 2010). Interestingly, at the Russian

Gravettian Kostënki-21 site (southern assemblage), the only mammal bone associated with ochre is the maxilla of a 'dog-like in size' canid (Reynolds et al. 2019). Decorated wolf/dog metapodials and copies of these bones carved out of mammoth ivory testify to the symbolic significance large canids held for the people from the Russian Avdeevo site, dating from the Gravettian (Gvozdover 1995).

At the Gravettian Předmostí site, several canid remains bearing sign-related modifications have been unearthed (Germonpré et al. 2012, 2017b). A few Palaeolithic dog skulls from the Předmostí assemblage were at the time of their death manipulated and modified by prehistoric humans: their braincases were perforated (Germonpré et al. 2012), in a way akin to the perforations executed during bear, wolf and dog sending-away ceremonies of the Ainu (Akino 1999; Walker 2005) or during Khanti bear rituals (Jordan 2003). Another Palaeolithic dog was inserted a bone fragment between its front teeth (Germonpré et al. 2012; Germonpré et al. 2017b) (Fig. 11.2), reminiscent of the food Mongolian and Oka-Soiot dogs receive upon burial (Lugli 2016; Oehler 2018) or the gifts wild canids receive by the Koyukon people after being skinned (Nelson 1983).

At Eliseevichi, a Russian Epigravettian mammoth site dated at *c*. 17,000 years, a skull from a Palaeolithic dog was found in a hearth near a concentration of mammoth skulls (Polikarpovich 1968). Its braincase is perforated at both sides. Cut marks occur on the zygomatic and frontal bones. Both carnassial teeth were removed by damaging the alveolar rims. The location of the skull and the manipulations this animal underwent suggest a ritual context (Sablin & Khlopachev 2003; Germonpré et al. 2009; Demay 2019).

The Magdalenian double burial of Bonn-Oberkassel include skeletal elements of two dogs. The human skeletons and the remains of the young dog that suffered from canine distemper were sprayed abundantly with red ochre. One tooth pertains to an older and smaller dog (Street et al. 2015; Janssens et al. 2018). Possibly, these dogs died at the same time as the man and the woman. Maybe, they were sacrificed so to be interred together with the dead humans to take the role of spirit guide into the after world (Street et al. 2015). Whatever is the interpretation of this collective burial, it forms indisputable evidence that the dogs, of which at least one had received considerable care before its death (Janssens et al. 2018), were part of the life and death of Upper Palaeolithic hunter-gatherers.

The anthropogenic handling and modification of Palaeolithic dog remains from the above-mentioned sites testify of the special symbolic connotation and ritual importance these domestic canids held within some Upper Palaeolithic societies. It has been proposed that elaborate rituals can be related to the monopolization of special knowledge, can provide mechanisms for social differentiation and can produce authority positions (Owen & Hayden 1997; Artemova 2016), although there is no direct evidence of this relating to the dog rituals described above.

An additional type of contribution is the prestige role of Palaeolithic dogs (Table 11.1). The cost of managing Palaeolithic dogs by Upper Palaeolithic hunter-gatherers must have been high and probably this was only possible during times and at locations when surplus food, which could be stored in pits or on scaffolds, would be available and/or when the advantage of having dogs would outweigh the costs of keeping them. The pre-LGM Palaeolithic dogs and 'dog-like in size' canids are mostly found in sites with a preponderance of mammoth remains and/or with evidence of mammoth hunting such as the Gravettian Předmostí (Czech Republic) and Kostënki-1 (Russia) sites (e.g. Germonpré et al. 2012; Germonpré & Sablin 2017). Also, several Epigravettian mammoth sites from the central East European plains, like Mezhirich, Mezin, Yudinovo and Eliseevichi, delivered remains from Palaeolithic dogs and 'dog-like in size' canids (Sablin & Khlopachev 2002; Germonpré et al. 2009; Germonpré & Sablin 2017). Ethnographic data reveal that the specialist hunters of forest elephants had tremendous prestige, held secret knowledge transmitted to them by their fathers (Bahuchet 1985), and were much appreciated for their high contribution to meat sharing (Duda 2017). During the Aurignacian, the Gravettian and the Epigravettian, mammoth meat was regularly consummed in Western, Central and Eastern Europe (e.g. Bocherens 2015; Germonpré et al. 2008; Wißing et al. 2019). Mammoth ivory was used as a source of tools, ornaments and statuettes (Gaudzinski et al. 2005; Khlopačev 2006; Khlopachev 2013; Wolf & Vercoutere 2018; Borgia 2019; Lázničková-Galetová 2019). Gravettian human burials were often covered by mammoth scapulae (Svoboda et al. 2008b). The mammoth was part of the life and death of Upper Palaeolithic people (Barkai 2019; Hussain 2019). Probably, the men who led the hunts on this meaningful and weighty mammal must have been experienced. Palaeolithic dogs could have helped these specialists with the sharing of the meat of the killed animals by transporting body parts from the kill sites to the residential camps where the meat from the hunted mammoths could be distributed. In this way, the incipient dogs could have contributed to the prestige of the mammoth killers. At camp sites, it seems that the diet of the Palaeolithic dogs was controlled. The reconstruction of the diet of several Palaeolithic dogs from the Gravettian Předmostí site revealed that the Palaeolithic dogs were fed reindeer and muskox meat. The absence of mammoth in their diet suggest that, in contrast with other carnivores, they did not have access to mammoth carcasses and thus likely were tethered for at least part of the time (Bocherens et al. 2015). This could suggest that they also functioned as sentinels. The abundancy of the mammoth, a preferred food of the Předmostí human (Bocherens et al. 2015) and other early modern humans (Drucker et al. 2017; Wißing et al. 2019), permitted that animals that likely were hunted for other resources, e.g. reindeer which's skin was undoubtedly sought for tailoring cloths and making tent coverings, were available as food for Palaeolithic dogs. In addition, it seems that also the diet of domestic canids from Late Glacial sites was controlled by humans (Baumann et al. 2020). Recent studies on stable isotopes of faunal remains from the Epigravettian Mezhirich site in the Ukraine and Magdalenian sites in Central Europe showed that some, but not all large canids did consume mammoth meat (Drucker et al. 2014, 2018; Baumann et al. 2020). The dog-like canids had a diet dominated by reindeer and horse (Baumann et al. 2020).

Differential burial types, specialization in production and /or remains of monumental architecture at these Gravettian and Epigravettian sites suggest a developed system of ranking among these Upper Palaeolithic societies (Soffer 1985; Wengrow & Graeber 2015). The Palaeolithic dogs from these sites were rather large, having an estimated body mass of about 36 kg (Germonpré et al. 2015); the fact that they required a lot of food could in itself have signalled the status of their masters. Post-LGM Palaeolithic dogs found at several Western and Central European sites are smaller (Nobis 1986; Chaix 2000; Vigne 2005; Pionnier-Capitan et al. 2011; Napierala & Uerpmann 2010), having estimated shoulder heights ranging from 30 to 45 cm (Pionnier-Capitan et al. 2011). Their smaller body size, compared to pre-LGM palaeodogs, could have permitted that they were nimble hunting companions, 'light enough to run over packed snow' (cf. Roberts 2017: H1). The assemblages at these post-LGM sites are dominated by mammals as reindeer, red deer, roe deer, ibex, aurochs and/or horse; the woolly mammoth, woolly rhinoceros and large carnivores such as the cave hyena, cave bear and cave lion were already extinct or had become scarce by that time. In these conditions, smaller dogs would have been more opportune, because they would require less food (Germonpré et al. 2012). This could maybe imply that their influence on status and prestige of their masters could have had less bearing.

Palaeolithic dogs and social inequality

Thanks to their Palaeolithic dogs, Upper Palaeolithic hunter-gatherers could have accessed a larger variability of resources, improved their living conditions, managed better their environment and facilitated their mobility. The competence necessary to conduct ceremonies in which Palaeolithic dogs played a ritual role could suggest that a monopolized knowledge, which could have been hereditary, was present in some Upper Palaeolithic societies.

Palaeolithic dogs must have been very costly to keep, and only wealthy families must have been able to do so. Likely, dog husbandry signalled material wealth. Households probably could have taken care of only a limited number of Palaeolithic dogs. However, in a given region the dog population size must have been large enough to be viable and it is likely that incipient dogs, probably puppies, were readily exchanged. Laikre et al. (2016) proposed that the metapopulation effective size of Fennoscandian wolves should amount to at least 500 for long-term genetic viability, so we tentatively assume that in a given region the effective population size of Palaeolithic dogs could sum up to 500. We consider it plausible that during seasonal gatherings at aggregation sites, puppies, maybe foremost male dogs (cf. Phung et al. 2019), were traded or exchanged. Palaeolithic dogs were likely not a scarce good. Talented dogs and their offspring, on the other hand, must have been much valued. The presence of large Palaeolithic dogs and 'doglike in size' canids at residential sites, such as Předmostí, Kostenki-1/I and Eliseevichi, with male burials and/or female figurines (cf. Pettitt 2018) and with evidence of specialization in ivory bead and tool production, exploitation of fur bearers, procurement of exotic materials, and mammoth hunting – features that likely refer to some sort of social complexity – is perhaps not a coincidence. Nevertheless, there is evidence that Palaeolithic dogs lived already together with humans during the Aurignacian (Germonpré et al. 2019). The beginnings of the domestication process of the wolf were likely driven by many motives, not just prestige and status (Germonpré et al. 2018) and could have arisen in egalitarian societies.

Based on the ethnographic and archaeozoological evidence, we summarize here a tentatively narrative on how the utilities of Palaeolithic dogs could have contributed to the daily life of past humans, how this could have enhanced differential access to resources, how it could have affected differential wealth and how this could have influenced social distinctions among men and women of the Upper Palaeolithic. We proposed that, initially, wolf pups were adopted and raised primarily for their significance in the cosmology of some Upper Palaeolithic societies, their ritual importance and their fur (Germonpré et al. 2018). Women must have played a primordially role in this by caring for and feeding the blind, helpless wolf pups and by dressing the skin of the (young) adult wolves for cold adapted clothing for themselves, their children, spouse and other dependents. The grown captive wolves were probably killed by men during rituals and for fur harvesting. The costly keeping of these animals must have signalled status and the raising of these canids likely increased the embodied and relational wealth for both the women and men who owned captive wolves. In a next step, early Palaeolithic dogs could have guarded camp sites, hauled firewood and water and accompanied women and children on gathering trips, and in this way augmented the embodied and relational wealth of their female owners. Palaeolithic dogs could have transported big chunks of meat from large game, such as the highly esteemed mammoth, from the kill sites to the residential sites and acted thus as a kind of partner of the male hunters by helping to share highly valued benefits. This aid must have increased the social standing of successful hunters of big game. In addition, by carrying additional supports, Palaeolithic dogs permitted their masters to undertake longer journeys which helped to obtain exotic goods, support and information and to develop extensive long-distance networks, adding to the relational wealth of their male owners. Furthermore, talented Palaeolithic dogs could have been lent to needy people. Such a sharing could have signalled the generosity of the male and female dog owners and augmented their reputation (cf. Stibbard-Hawkes 2019). Probably in a later phase, maybe in the Late Glacial, Palaeolithic dogs became real hunting companions; this would advance the embodied and relational wealth and augment the social status of their male masters.

We propose that from the early beginnings of the wolf domestication, canids had the capacity to augment the embodied and relational wealth and the social status of their male and female owners. Thanks to intergenerational transmissions of these assets, Palaeolithic dogs helped to increase the fitness interests of their masters. Although ownership of Palaeolithic dogs was probably not crucial for the development of non-egalitarian hunter-gatherer societies, the presence of palaeodogs could, nevertheless, have contributed to the enhancement of inequality in the Upper Palaeolithic. Domestic canids probably influenced more the social status of their masters in those Upper Palaeolithic economies that were based on large game hunting and important food storage, that had reduced residential mobility but pronounced logistical mobility and in which ceremonies were regularly held.

Further research, though, is necessary to confirm and extend this simplified narrative. However, in our opinion, due to the poor archaeological record it would be hard to discern direct evidence that the ownership of Palaeolithic dogs would benefit individuals. Furthermore, we believe that the balance of advantages and costs of Palaeolithic dog husbandry depended on climatic variables and environmental characteristics and that a positive outweigh was probably more pronounced in more northern regions (see also Schnitzler & Patou-Mathis, 2017).

Conclusion

With this chapter we want to illustrate how Palaeolithic dogs could have contributed to a better life for their masters and whether this could have enhanced social inequality among the Upper Palaeolithic hunter-gatherers. By comparing the ethnographic and archaeozoological record, we propose that Palaeolithic dogs could have functioned as sentinels, attributed to a less-strenuous mobility, acted as social companions and hunting aides, been kept for their fur, bones, meat and fat, participated with body and soul in feasts, ceremonies and rituals and been prestige displays. It is clear that the roles Palaeolithic dogs played in the symbolic and ritual realm were very important; it is these functions that are best registered in the archaeozoological record of the Upper Palaeolithic (Table 11.1). The feeding of the Palaeolithic dogs must have been a burden for their masters and keeping many dogs could have been a display of high status (cf. Driscoll 2010). Furthermore, it cannot be excluded that a sharing practice of dogs existed among some of the Upper Palaeolithic hunters-gatherers. Although Palaeolithic dogs did not help to accumulate material wealth, they likely enhanced differential access to resources, increased the embodied and relational wealth and fitness benefits of their masters and, although they were not a crucial factor, they could have attributed to some form of social inequality in Upper Palaeolithic societies. It can be hoped that a multidisciplinary approach, including osteometrical, archaeozoological, biogeochemical and genetic methods, can result in a better understanding of the enduring impact of the interactions between Upper Palaeolithic peoples and their dogs on both species and others.

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Chapter 12

Social ecology of the Upper Palaeolithic: exploring inequality through the art of Lascaux

Paul Pettitt

If it is true that inequalities among men follow from the very concept of societies as moral communities, then there cannot be, in the world of our experience, a society of absolute equals (Dahrendorf 1968: 176).

In this chapter I will argue a case for social inequality among a specific Late Upper Palaeolithic group – the Lower Magdalenian artists of Lascaux – by way of exploring the thematic concerns of its art. In this sense I try to add a thematic dimension to existing arguments for social inequaity in the Palaeolithic. Beginning with an examination of anthropological evidence for inequality among recent hunter-gatherer groups in broadly similar environments to those of the Magdalenian, I will argue that the social organization of their animal contemporaries – a considerable knowledge of which is evident in Lascaux's art – forms an appropriate analogy for the social organization of Magdalenian groups. As we will see, none of the prey animals that Magdalenians were dependent upon for survival could be said to be socially egalitarian in any way. As this is the case, why, therefore, might we expect the sympatric Magdalenian hunter-gatherers to have been? I will argue that detailed observation of the behaviours of their herbivorous prey formed a natural model for Magdalenian social organization, and that the resulting social signalling and concern with competition and creation reflected in Lascaux's art resulted not so much from the 'ritual mind' of egalitarian groups, but from concerns relating to the maintenance of a social structure in which competition and inequality were endemic. I am not stating that such a model should not apply to other Upper Palaeolithic periods; I simply restrict my discussion here to one useful case study by way of example. Given the propensity for hunter-gatherers not to draw a strong distinction between 'human' and 'animal' or even between individuals, it seems appropriate to me, when discussing inequality, to deal with the ecosystem at large. After all, what is Palaeolithic art reflecting if not a social ecology? In this endeavour I am particularly inspired by the recent consideration of hunter-gatherer inequality by Wengrow & Graeber (2015), the important implications of which I discuss below. Overall, I conclude that it is *inconceivable* that the Lower Magdalenian complex hunter-gatherers were organizationally simple, or 'egalitarian'.

We must begin by considering exactly what we mean by 'inequality'. The influential political scientist Ralf Dahrendorf noted that we must distinguish between inequalities of natural ability and those of social position; and also between inequalities that do not involve any evaluative rank order, and those that do. Although from today's perspective Dahrendorf's arguments lacked consideration of age and gender, and that modern perspectives have greater nuance of inequality, his recognition of four types of inequality forms a useful heuristic. He identified *natural differences of kind* in features, character and interest; *natural differences of rank* in intelligence, talent and strength; *social differentiation* of positions that are otherwise essentially equal in rank; and *social stratification* based on reputation and wealth, expressed in a rank order of social stratification (Dahrendorf 1968: 154). As some of these are distributive in nature (e.g. encapsulated or expressed in/with material culture or 'wealth'), and others non-distributive (e.g. personal charisma), the question must be posed as to what *currencies* of stratification were available in the Upper Palaeolithic. I will argue that the skills necessary for the material provisioning and artistic creation of a major Palaeolithic art site form one such set of currencies. In order to nuance my argument I will assume that inequality can take many forms and need not be restricted to the fixed, hierarchical 'ranking' and 'stratification' implied by political dominance; instead I view it as flexible, changing and under constant negotiation.

I hope it is fair to state that most Palaeolithic specialists agree that the diverse and complex skills represented in lithic and osseous tool manufacture, art production in various media and forms, landscape memory, rare and apparently restricted elaborate burials, and the complex tasks of hunting and gathering of diverse animal and plant taxa in the Magdalenian surely reflects a strong degree of individual specialization. How could a single individual be adept at producing finely retouched and truncated lithic bladelets, osseous Lussac-Angle points or low relief decorated *baguettes demi ronde,* trapping of arctic hares and hunting reindeer, horse and bison, let alone planning, provisioning and producing the art of Lascaux? To assume a developed level of individual specialization is, therefore, uncontroversial, although of course distinctions between individuals through their occupational specializations (one might say, expertise) need not imply any distinctions of rank or value between individuals, however uniquely or impressively skilled they may be (Dahrendorf 1968: 162). There need be no intrinsic rank distinction between individuals of different specialisms ('hunters' versus 'knappers' for example); in order to ascribe such rank distinctions requires a second act of *evaluation* by which a social stratification of activities is based upon a set of activities which in functional terms are merely differentiated in kind (ibid.: 163). It therefore does not necessarily follow that social *differentiation* and social *stratification* must always explain each other or be inextricably linked; instead, for stratification to arise requires some form of intermediate agency. While differences between tasks, for example in terms of the knowledge and skills they require, their pleasantness or unpleasantness, ease or difficulty, may have connotations of functions and dysfunctions, it does not necessarily follow that these would explain the origins of inequality *per se*.

We can certainly assume that human society, in the Upper Palaeolithic as much as today, structures social groups by removing individuals from random chance, and regulates itself in terms of various expectations (norms). These are usually reinforced by positive or negative sanctions (rewards and punishments) for conformist or deviant behaviour respectively (Dahrendorf 1968: 167). Because of this, as individuals are subject to the sanctions designed to enforce social principles, a core of inequality must be expected in such societies, as sanctions are a conspicuous expression of a ranking process. As social norms and sanctions are agreed upon by the social group, through a process of discrimination (value decisions about what is morally right and wrong), it follows that such norms are 'the basis not only of ephemeral individual rankings but also of lasting structures of social positions' (ibid.: 169). Hence, in any society where norms and sanctions exist as expressions of moral correctness, one might expect the *origins of inequality,* as ('bad') transgressors cannot be held to be equal to ('good') conformists. As Dahrendorf succinctly phrased it, 'all men are equal *before* the law but they are no longer equal *after* it' (ibid.: 169–70 emphases original). Hence, as soon as a society is structured by expected norms, 'a rank order of social status is bound to emerge' (ibid.: 170). The resulting social inequality plays the critical role of guaranteeing a society's dynamism and 'historical quality' (through the constant negotiation of rank in terms of social norms), hence to Dahrendorf, 'the idea of a perfectly egalitarian society is not only unrealistic; it is terrible' (ibid.: 178). Given that the regulation of social groups by norms and sanctions appears to be universal, however, one might simply conclude from Dahrendorf's argument that all societies must inevitable be non-egalitarian (Brian Hayden, pers. comm.). If nothing else, however, this should suggest that the *basis* for inequality – however feint – is a universal.

Assuming Dahrendorf is correct, the question we must pose is, therefore, not so much *when* did social inequality arise, but *how* Palaeolithic societies regulated themselves with social norms, how variably strong or weak this regulation might have been, and how it may have been expressed in non-perishable archaeology. The relative homogeneity over large territories of material culture (e.g. Lower Magdalenian lithic and organic toolkits, and art) is, to my mind, evidence of a strong conscious or subconscious 'corporate' norm of quotidian life, but how do we explore the surviving archaeological record for any expression of explicitly moral or social 'norms'? My assumption here is that the largest and most complex examples of Palaeolithic cave art, whatever their ostensible function in the 'ritual' sphere, will, to an extent, express the social norms that rituals exist to reinforce and, therefore, function to regulate them. To put it another way, art will, to some extent at least, express and repeat both social and cultural norms. I will argue, therefore, that Palaeolithic art –or at least the more elaborate expressions of it – can be 'read' as a statement of socially accepted conventions, and in exceptional cases, can be interrogated for details of the form that such conventions took. I undertake such an interrogation here, restricting my discussion to the art of the French Lower Magdalenian; notably Lascaux, although by extension to Gabillou, Le Portel, the Grotte du Sorcier (St. Cirq) and others, which are considered to be broadly contemporary on the basis of thematic and stylistic similarities.

Hunter-gatherers

Recently, two of the most pervasive beliefs about hunter-gatherers have been seriously undermined. Bird et al. (2019) demonstrate that we can no longer assume that prehistoric hunter-gatherers lived in small groups comprised of a few dozen closely related individuals who collaborated to appropriate resources from unmodified landscapes. Instead, they suggest on ethnographic grounds that local groups of foragers may be small (albeit fluid) yet are drawn from 'expansive, trans-generational networks of regional wealth, bound together in ties of social interaction that extend well beyond a small community of individuals', and hypothesize that 'these large societies and anthropogenic landscapes are inherent features of the Pleistocene spread of modern humans' (ibid.: 106). The long-held assumption that a fixed egalitarianism is the default orientation of hunter-gatherers has been questioned on a number of grounds. Testart (1988) noted that the process of sharing resources appropriated from nature is a never-ending phenomenon, constantly circulating resources from producers to non-producers as active roles in the social group changes. It is this constant social flux that should form the basis of all subsequent discussion. Arguing that hunter-gatherers should not be treated as one homogeneous category, Shnirelman (1992) noted how unequal distribution and redistribution of appropriated products was well known at least among complex hunter-gatherers. Recognizing that complex hunter-gatherers were frequently ignored in general theory building, Arnold (1993) identified chiefly complexity (hereditary inequality, hierarchical organization including political authority at a multi-community scale, and partial control over labour by the elite) among several complex hunter-gatherer groups, noting that labour may be manipulated by elites in fields such as subsistence strategies, the acquisition and working of non-food resources, technology, transportation (e.g. canoe building and use), and communication, to quote only a few. She stresses how inequality can arise through processes of reorganization of 'commoner labor', focused on labour investments and internal and external stressors such as resource declines, population increase, and hostile interactions. Recently, Wengrow & Graeber (2015) have added a new dimension to our understanding of complexity and inequality. Reviewing a century of discourse about social organization in the Palaeolithic, and the tendency among anthropologists to brush aside examples of hunter-gatherer inequality, the authors demonstrate how deep rooted the equation of hunter-gatherers with egalitarianism has been. Revisiting ethnographic evidence, Wengrow & Graeber show not only how inequalities did exist among several foraging groups documented over the last two centuries, but, most importantly, that social organization could be particularly fluid over the course of the annual subsistence round. In some seasons, skilled individuals or high status families could control aggregations in an essentially stratified social context, whereas the same groups could fission into egalitarian organization at other times of the year. The result is essentially two distinct ways of being within the same social group, neither of which is thought to be incompatible with the other. Art often functioned to negotiate and express such fluidity, and of particular note here is the centrality of art groups to discourses on individuals, roles, names, families, and social organization among the Inuit, Kwakiutl and others (ibid.: 11), and the relatively high amplitude of such discourses during seasonal aggregations (13). If it is correct to assume that Lascaux's art was created largely during a nearby aggregation (see below) then one might expect it to have included such a discourse about individuals, groups, and power, whether or not this was its primary purpose.

Sharp (1991) noted how anthropologists tend to characterize societies in terms of a presumed absence of particular features, which derives from the prevailing dogma about these groups. Hence, lacking any obvious evidence of elaborately provisioned 'chiefs' Palaeolithic hunter-gatherers are defined as egalitarian as they cannot be associated with anything else. As Ingold (1999: 403) noted, this negative characterization of hunter-gatherers as 'egalitarian' is an obvious outcome of the 'step-by-step', simple to complex paradigm that has dominated narratives of social evolution, explaining the prevalent dogma that Palaeolithic hunter-gatherers must have been 'egalitarian', simply by virtue of their being an early step on the social road, irrespective of a total lack of evidence for this notion whatsoever. The notion that primitive societies were egalitarian could be said to begin with Rousseau; continue through the 'primitive communism' of Marx and Engels; and subsequently formed a major constituent of Morgan's stage of 'savagery'. During the twentieth century, the realization that not all hunter-gatherer groups were egalitarian was occasionally recorded by anthropologists, although largely ignored, notably by Service (1962), who in his influential *Primitive Social Organisation* viewed the Palaeolithic as a period in which there were 'no forms of economy *higher* than hunting-gathering bands' in which 'all the functions of culture are organised, practiced and partaken of by no more than a few associated bands made up of related nuclear families'…with 'no special economic groups or special productive units…no specialised occupational groups…no religious organisation standing apart from the family' (1962: 46, my emphasis). Instead, the economy was 'not separately institutionalised…there is no formal economy at all' (ibid.: 98).[1] The notion was perpetuated at the *Man the Hunter* symposium of 1965 (Burch & Ellanna 1994: 219), despite the fact that the resulting publication reveals several examples of individual leadership. Among the Netsilik and Iglulik, for example, extended families were lead by their eldest males, and the band was lead by the head of the largest family (Damas 1968: 115). Several Australian aboriginal groups were lead by 'headmen' with powers of 'command' (surely a word evocative of inequality if there ever was one), even if it is contentious whether such power passed from father to son prior to European contact (Pilling 1968). By contrast, among the matrifocal Hadza, although organization varied from group to group and there were no institutionalized leaders, some individuals stood out 'influential persons' (Woodburn 1968: 109). Woodburn (1982)… whose points serve, as Ingold (1999: 404) noted, to demonstrate that 'power works by attraction rather than coercion' and that relations between leaders and followers in bands 'is based not on domination but on trust.' Inequality can, therefore, be a positive thing.

The *Man the Hunter* publication presented a number of arguments for an essentially 'fluid organisation' of hunter-gatherers which paralleled the flux of their resource base (Lee & DeVore 1968: 7–8) although with hindsight it did not explore the implications of this observation. Instead, its promotion of the egalitarian model of society and the over-emphasized equation of males with hunting 'gerrymandered women out of hunting by semantic manipulation of definitions' (Brumbach & Jarvenpa 2006). Despite this, Woodburn (1982) demonstrated that societies with delayed return subsistence systems did possess inequalities, and as a result immediate return groups needed to stress (i.e. actively work to maintain) their egalitarianism rather than take it for granted. Among the Pacific Northwest Coast societies, Hayden (1994) showed how competition over resources could lead to gain (i.e. accumulation) and hence inequality when the resource base was rich enough. Subsequent to this, Hayden has developed our understanding of the role of social aggrandizers and strategies by which they promote their own self-interests, particularly in the sphere of secret societies which emerge in transegalitarian societies, have intrinsic rank distinctions perpetuated by the control of secret knowledge (notably connections with supernatural beings), and can be a convenient way to control (i.e. appropriate) the distribution of surplus (Hayden 2019).

A few specific examples should suffice to draw out the nature of inequalities recorded among varied groups and to show that, while little or no social stratification does seem to characterize some hunter-gatherer societies, this can hardly be said to be some kind of primitive or 'default' condition. By contrast, however, social inequality need not be predicated on relations of dominance and subservience (although it may be); with systems of complementarity based on individual economic contributions differing, for example, by gender or age, unequal distinctions between individuals could emerge. Highly variable social complexity has been demonstrated across the Canadian Arctic; Burch & Ellanna (1994: 220) recorded social ranking among most groups of the North pacific Rim, incipient ranking among Alaskan Eskimos, and, more widely, a fully developed class system among the Calusa foragers of southern Florida ('some of the most politically and socially complex communities ever known among hunter-gatherers': Hayden 1994: 237). Mauss (1950; see also Wengrow & Graeber 2015: 10) noted how Eskimo societies assumed different social morphologies at different times of the year, corresponding in modern terminology to the ubiquitous hunter-gatherer fission-fusion pattern. An opposition between summer and winter life profoundly affected Eskimo 'ideas, collective representations and, in short, the entire mentality of the group' (Mauss 1950: 60). Summer settlement was highly dispersed, with a single family occupying their own tent, usually erected a considerable distance from others. As summer turned to winter, however, Mauss noted 'a complete change in morphology of Eskimo society' (ibid.: 38). Settlement became more nucleated, with close groupings of winter longhouses, each holding some 8–12 families, sometimes more, united by a central communal structure. Following this, distinct laws existed for each of these two seasons; in summer these were essentially patriarchal, with males holding the predominant role as provider and by male children of hunting age, and they essentially constitute the family group. During the winter, this nuclear family became subsumed into a greater collective of 'housemates', linked by moral ties, several of which constituted the 'clan' settlement. In this collective context, there was considerable leniency towards crimes, and all social groupings were subsumed into a collective epitomized by the sharing of sexual partners. In the summer, individuals were distinguished from each other as sharply as families, and strict rules of ownership were defined by male and female properties to the extent that individuals were strictly associated with specific objects. In winter, however, a 'generous collectivism' prevailed (ibid.: 72), in which collectives had access rights to resources and longhouses as the joint property of all 'housemates.' An opposition to individual/patriarchal summer rights was accentuated in communal law, particularly where rights over portable property held by individuals dissolve in the face of communal rights of access.

The ritual expression of religious belief is well known to be critical to the maintenance of intra-group cooperation, as a visual and somatic means of repeating social norms encoded in group-specific beliefs, and in the form of costly signalling (Irons 2001; Sosis & Alcorta 2003; Rozen 2004; Murray & Moore 2009; Peoples & Marlowe 2012). Mauss noted how Eskimo religion varied according to the same rhythm as their social life. During winter aggregations, groups 'lived in a state of continuous religious agitation'; by contrast 'all the myths that…fill the consciousness of the Eskimo during the winter appear to be forgotten during the summer. *This is the time when myths and legends are transmitted from generation to generation*' (ibid.: 57 my emphasis). During the summer, therefore, any collective mishaps were seen as violations of ritual prohibitions, and were mitigated conspicuously during this intensely collective season. Festivities were accompanied by collective sexual licence, producing '*a fusion of individual personalities*' (ibid.: 60, my emphasis). By contrast, the individualized and isolated summer practices were restricted to private rites of birth and death as they occurred within families.

It should be clear from these brief examples that Upper Palaeolithic social groups should not be viewed as having been organizationally simple and monolithically organized. It should also be clear that art, and whatever wider activities it formed part of, functioned at least partially to repeat and emphasize culturally encoded social norms. Although the relatively few studies that consider this issue typically contain caveats that such examples are drawn from relatively recent groups, may not exist in exact ecological comparanda for Pleistocene groups, and often interact with neighbouring farmers and other drastically different human groups, they still make it implicit that these comparanda have relevance. Why should complex hunter-gatherers of the Upper Palaeolithic have been organizationally simpler that these recent groups, just because they are chronologically earlier? We can at least draw on the anthropological examples, as Wengrow and Graeber comprehensively do, to develop an agenda for examining the Palaeolithic record for evidence of differing social organization, rather than simply assume an egalitarianism that probably never truly existed.

Every human social group that has been observed and recorded has a division of labour (Béteille 1994: 1021). Gender, and the question of whether divisions of labour based upon it may lead to social inequality, forms a major concern of anthropology, as the subordination of women to men is, sadly, universal – if highly variable – in expression (Moore 1994: 821). Most social theorists agree that inequality is probably inherent in any form of collective living, and as most societies have systems for evaluating natural and humanly made objects and expressing preferences within these, it would be odd if they did not have systems for doing the same with human individuals, e.g. good food/bad food = good cook/bad cook (Béteille 1994). Such systems make statements about a society's aesthetic and moral categories, transforming preferences in the material world into judgments about an individual's qualities and performances. The inequalities that result from this may not simply exist in equilibrium, however; they will need resolving, and the usual way to do this is by negotiation and force (ibid.: 1020).

Individual negotiation can be subtle, however. Among the Chipewyan – a society largely dependent upon the hunting and trapping of meat – women have a subordinate role (Sharp 1976, 1994). They are not without influence, however; there are several ways in which they exercise a 'power of weakness' in the context of male dominance (Sharp 1994).Taking into account the pursuit and despatch of hunter prey, as well as the post-kill processing phases of hunting, that is taking 'hunting' to be a prolonged and complex system of travelling, observation, mobility, dispatch, transport, transformation and sharing among circumpolar groups (Brumbach & Jarvenpa 1997), the material and economic contribution of women to 'hunting' among circumpolar societies is certainly 'no less compelling than mens' (Jarvenpa & Brumbach 2009: 71). Casting aside misleading perspectives on 'sexual division of labour' gender is one factor among several (including group size and composition, age, season, activity) that constitutes the complex interaction of specialized knowledge and experience that defines the labour base (ibid.: 65–6). I will not explore gender here *per se,* but simply note the complex arenas in which knowledge and experience – forms of *expertise* as one might call them – constitute quotidian activities. Such arenas of negotiation engender differences in toolkits (there are men's gear, women's gear, and communal gear); jobs may be defined as female, male, or shared (ibid.: 72), and 'divisions of labour' can be very flexible. Most notably, expertise can enhance social status, for example with the Yup'ik female herring processing masters. Female skills are often those that involve *transformation*, notably of carcasses into meat, clothing and other equipment (Brumbach & Jarvenpa 1997).

Archaeologists and ethnographers have tended to treat all societies for whom stratification is not evident as simply 'egalitarian', a simplification that ignores a richly nuanced and variable set of organizational differences (Brian Hayden pers. comm.). Table 12.1 orders available information from recent hunter-gatherers operating in broadly similar environments to those of the Upper Palaeolithic, ordered according to the three pertinent categories of Dahrendorf's four types of inequality (his fourth type, a fixed order of social stratification, is absent from accessible ethnographic accounts). It can be seen that there are numerous examples of social differences between individuals in these groups which are not reflected by absolute (i.e. clearly defined and fixed) distinctions of rank or indeed do not inevitably lead to ranking, but which are nevertheless described in terms such as 'rich', 'strong', 'mature', 'senior', 'headmen' and 'ritual deference'; (for a specific example of a non-egalitarian group refer to the entry on the Khanty). In addition to these, several examples of social differences exist which *do* lead to a rank ordering, i.e. a degree of social stratification, which are described in terms of 'status', 'hierarchy', gender, and 'hereditary leadership' (note that among the Caribou Inuit, shamans have overall authority). In this sense, then, by 'social inequality' I refer to any active *distinction* made between individuals in the social arena – decision making and influence, visibility, accumulated wealth, costly signalling and demonstrable dominance of others. I recognize these distinctions irrespective of their causal links, e.g. age, gender and skills.

Guy (2017: 39) has questioned the simple assumption that Palaeolithic hunter-gatherers were egalitarian, drawing on Testart (1982), who noted that the accumulation of surplus among delayed-return hunter-gatherers is strongly correlated with social stratification. It follows that any form of storage of a resource surplus should lead to a degree of inequality (Guy 2017: 51–4). Of particular note is Guy's consideration of how Palaeolithic art should function in the context of inequality. Using the Pacific Northwest Coast societies as an example, he notes how art objects and rituals are coveted specifically because they refer to hereditary privileges which are encoded in jealously guarded secrets. It would be easy here to underestimate 'art' and 'ritual' as being simply a 'specialist' activity; this would be to miss the point of 'specialization', the manufacturing secrets of which mark artists of the Pacific Northwest Coast out as a *distinct cast*, distinguished by artistic 'blazons' which refer to their descent group, particularly during the competitive context of seasonal aggregations (ibid.: 55–7). Guy sees this artistic expression of privileged groups as underpinning the regional thematic and stylistic variation visible in Upper Palaeolithic art, which one might expect would come together at major sites such as La Madeleine and Laugerie-Haute/Basse whether or not the 'aggregations' responsible for their rich stratigraphic and archaeological inventories were seasonal or more prolonged (ibid.: 145; Fontana 2017). One would expect that aggregations of relatively numerous individuals would provide relatively strong opportunities for social aggrandizement (Hayden 2009). If it is correct, therefore, that Lascaux's art was created in the context of a nearby aggregation, then it is reasonable to expect that social negotiation between individual aggrandizers and groups formed an integral part of the creation of its art and whatever other activities that accompanied. It would therefore be pregnant with social signalling (Gittins & Pettitt 2017).

In addition to hunter-gatherer analogues, there is, however, another set of comparanda that have not been considered as potential models for Upper Palaeolithic social organization. These are the gregarious herbivores that co-occupied the Upper Pleistocene tundras with Upper Palaeolithic groups, the hunting of which was critical to the survival of these groups. Magdalenians were notably dependent on horse, reindeer, and bison, supplemented by aurochsen, red deer, *Megaloceros*, ibex, saiga antelope and chamois, depending on time and place (Delpeche 1983; Burke 1995; Boyle 1997; Costamagno 2000; Turner 2002; Weinstock 2002; Langlais et al. 2012; Fontana 2017).[2] In addition to this ecological sympatry, the treatment of animal carcasses on a spectrum from the alimentary (diet) and technological (artefact and clothing manufacture) to non-alimentary (decorative and ritual) (Birouste et al. 2016), and the prominence of these prey animals in the canon of portable and parietal art (Lorblanchet 2007; Guthrie 2005; Bahn 2016), one can sensibly assume that Magdalenian hunters indulged in a constant and detailed observation, analysis, discussion and mythologizing of the distribution and behaviour of these animals, and privileged activities that would preserve such information. Such knowledge would not be restricted to the monitoring, prediction, recognition and identification of prey in the landscape, but would necessarily extend to their behaviour as individuals within a social group, their habits as a social collective, and their mobility, fission and fusion in the landscape over the course of the annual subsistence round (Aujoulat 2005). It is inconceivable that such observations were not interpreted, discussed, and compared to human behaviour and organization; as Lévi-Strauss (1962: 89) stressed, animals are good to think with. In short, the behaviour of animal prey must have been a major intellectual preoccupation – essentially a life-structuring principle – to Upper Palaeolithic hunter-gatherers. Given the universal nature of hunter-gatherer cosmologies (discussed below), it seems highly likely that Palaeolithic groups

Table 12.1. *Social inequalities among hunter-gatherer groups of the present and recent past with similar economies to Late Upper Palaeolithic hunter-gatherers.*

Group	Natural difference: rank	Social differentiation of position: equal rank	Social stratification: rank order	References
Blackfoot & other North American Plains groups			Leaders of 'higher status' emerged	Kehoe 1999
Slavey Dene	Traditional leadership provided by successful hunters; often selected by elders			Asch & Smith 1999
Caribou Inuit			Hierarchical family organization based on differences in relative age, generation and gender. Men have authority over women in a number of areas, and shamans have authority in general	Burch & Csonka 1999
Timbisha Shoshone		'Headmen' held authority relating to hunting within local camps		Fowler 1999
Gitxsan and Witsuwit'en			Hereditary leadership	Daly 1999
Ainu		'Headmen' central to decision making in most activities		Svensson 1999
Chukchi and Yupik		Many settlements have 'rich' or 'strong' individuals, almost always men, with limited decision making powers		Schweitzer 1999
Evenki		'Senior' males make decisions about camp location		Anderson 1999
Itenm'l		Groups lead by a 'mature, respected, wealthy man'		Shnirelman 1999
Khanti		'Significant wealth and power' held by 'rich male elders and shamans' who, despite kin obligations 'used poor people like slaves'		Bartels & Bartels 1999
Nivkh		'Ritual deference' to male clan elders		Grant 1999

would *identify* with their intimate prey, and from such identification, a social *alignment* would follow. How, then, were the other gregarious mammals organizing themselves on the Upper Pleistocene tundra? Certainly not as egalitarians, as we will now see.

Ethological context: prey animal social organization

The term 'herd' is often used to describe the large-scale social unit of gregarious herbivores, although these are actually highly fluid, informal phenomena, the term really only implying a large number of individuals largely acting in common, within a spatially defined area of the landscape (e.g. Chaplin 1977: 52). Horse society is essentially matriarchal, anchored around long-lasting relationships between mares and their offspring (Goodwin 1999). Additionally, three distinct social groupings are notable: harems dominated by a stallion and containing his mares and offspring of both sexes, of sizes of between 5 and 35 varying from group to group (Berger 1977); small, all-male bachelor groups; and solitary males. In temperate zones horses mate and give birth in spring; they leave their natal groups at sexual maturity. At this point their social trajectories diverge; males enter a bachelor group for up to 5 years, before establishing their own harem. Females go straight to an existing harem or a new one established by a promising male, and can breed immediately upon joining. Harems have a far more restricted mobility than bachelor groups (Berger 1977). Aggression is common; Prewalskis horses, for example, show frequent aggression, particularly among bachelor stallions (Feh 1988), although despite the popular conception that stallions are the most aggressive horse, this is often not the case, and it can be displayed by males and females (Goodwin 1999). Subtle changes in ear and tail positions, in addition to specific vocalizations, convey information within and between horse individuals and bands (McDonnell 2003), and through this, an established order of dominance and submission is generally maintained within and between the constituent groups of a herd. When this is maintained, overt fighting is reduced and competition can generally be settled by threats and retreats (ibid.: 91); dominant individuals can control the movement of their conspecifics or access to a limited resource by simple head toss threats or threat gazes, many of which are recorded in Magdalenian art. For much of the year, reindeer – the dominant resource for the Lower Magdalenian north of the Pyrenees – are organized in mixed sex herds of differing ages (Espmark 1964), within which a strong pattern of social dominance that involves all members of the herd, within which ranking is constantly in flux (Müller-Schwarze et al. 1979). Sparring and fighting increase in frequency close to the autumn rut, through which a rank order is established among bulls (Espmark 1964). Calves have the social status of their mother; females typically outrank yearling males, but otherwise rank order is effectively a matter of individual size, and hence male maturity. The harem size that a bull can maintain relates specifically to its capacity to congregate and keep it together, an activity which takes up much of its time, as it drives the group from behind through a moving territory (ibid.: 160).

Modern cattle, and American and European Bison, divide into cow/mixed and male (bull) groups, with competition and fighting common in the latter, particularly as they grow larger (Van Vuure 2002). Their organization can be highly flexible; they may be migratory over several tens of kilometres, and can form particularly large herds during the rut and calving (Peck 2004). Among the bovini in general, calving occurs in spring, and the core of social organization is the cow and her calf; cow groups are formed of up to 10 of such dyads, i.e. a total of 10–20 individuals, and bulls typically form their own herds of 2–10 animals. In some (not all) groups males may associate with cow herds in low numbers, while older animals of both sexes tend to be solitary. A general trait of the bovini is the tendency towards increasing isolation as individual bulls age (Van Vuure 2005: 266).

Deer are polygamous animals, who do not maintain mother-father-offspring social units, and while they are capable of recognizing individuals it is not clear whether they recognize their offspring when the latter are fully grown or after a period of separation (Chaplin 1977). For much of the year, red deer groups are split into hind and stag (harem) groups, with those of the same sex occupying largely distinct but partly overlapping ranges (ibid.: 58). Harem membership can vary through the year, although related hinds tend to be found in the same harems, and harem stability gradually increases during the early weeks of the rut. Changes in membership, however, can occur even during stable periods for diverse reasons, the most important of which is competition between neighbouring stags (Clutton-Brock, Guinness & Albon 1982). This aggression can cause family groups to fragment. Harem-holding stags can threaten hinds and promote their mother's departure, and young stags can aggressively infiltrate harems, chasing out hinds and fighting the harem-holder for dominance. Unlike hinds, stags do not invest heavily in individual offspring; their reproductive success depends instead upon breeding access to members of the opposite sex. Hinds aggregate in large groups, thus stags can monopolize access to a considerable number of hinds, with intense competition between stags for the harems during the autumn rut (ibid.: 105). Breeding success is highly dependent upon a stag's ability to control the behaviour of other animals – hinds, young stags attempting to infiltrate or abduct hinds from the harems of older males, or other mature stags. Consequently, fights over hinds are both frequent and dangerous.

Rutting stags will attempt to herd and defend a group of hinds against competitors. Rank is established by intimidation and/or physical contest, and hence mature individuals in their prime tend to dominate over the young and old, and the highest ranking stags will impregnate the largest number of hinds. Within stag groups every individual knows its place, and social order is maintained by slight gestures rather than threat displays; 'normally, dominance can be asserted by a look or a flick of the head or merely by the approach of the dominant animal' (Chaplin 1977: 64), although overt aggression will occur if a subordinate does not react appropriately to the warnings of a dominant one. Such 'disobedience' is usually an indication of an impending physical contest to decide whether the rank order should change.

It should be clear from this brief survey of the most common prey taxa sympatric with Magdalenian hunter-gatherers that the constant maintenance of social *order* underpins all social behaviour. This can often be achieved through subtle visual, audial and olfactory behaviours, but frequently needs reinforcing with aggression. Social organization is fluid, and dominance relationships are ubiquitous but can always be overturned, usually in very public (i.e. visible) ways. Notable common factors are the fluctuation between relative degrees of social stability or instability depending on the time of year; the prevalence of aggression in larger aggregations; and the control of individuals' behaviour by 'leaders'. I note in particular the social importance of female 'anchors' and male 'drivers', to which I shall return. It should be clear, however, that among modern examples of all of the most commonly encountered prey animals of Magdalenian groups, social organization is far from egalitarian.

Humans *as* animals, animals *as* humans

The conceptual world of hunter-gatherers, in which a distinct separation of human and animal individuals is lacking, draws the social lives of the Magdalenian and their prey even closer. In contrast to modern belief in the distinctiveness of individuals and the rigidity of difference between species, the notion that animals are both *human in part* and *animal in part* is probably universal among hunter-gatherers (Guenther 2015 and references therein). One should not assume that this blurring is universal or absolute; if it were the latter – i.e. that humans were thought of as no different to animals, the consumption of animal meat would be thought of as cannibalism, which it is patently not (Brian Hayden pers. comm.). Rather, varying degrees of similarity and overlap are apparent, and common enough to justify the caution that we should not think of Upper Palaeolithic hunter-gathers as completely conceptually distinct from their prey. The ways in which animals are thought to be human-like include their basic behavioural repertoire, e.g. eating, sleeping, attacking, and fleeing. Specialists agree that it is fair to assume that Upper Palaeolithic hunter-gatherer groups practised fission and fusion in similar ways to their sympatric prey (Gamble 1999), and certainly the variability in size and nature of Magdalenian sites supports this notion (Conkey 1980; White 1985). It goes without saying that as survival entailed positioning themselves advantageously with respect to their mobile prey, the organization of Magdalenian life would have to a large extent been symbiotic with these animals, particularly horse, reindeer and bison. It should, therefore, be sensible to assume that animals were central to how hunter-gatherers read their social world. Mauss (1950: 55) noted that Eskimo social life was 'a veritable phenomenon of symbiosis that forces the group to live like the animals they hunt', e.g. aggregating in winter to exploit aggregations of walruses and seals, and dispersing to exploit the rich hunting and gathering opportunities opened up by the summer, when snowshoes were not required and hence mobility was not restricted. Among the Pintupi of the Australian Western Dessert, social organization constitutes a *transaction in shared identity,* the practice of which is a continual negotiation about the relationship between individuals, animals, and objects (Myers 1991). Yet sharing is a coercive interaction within a cultural context (Sharp 1994: 40). As Ingold (1986: 252) noted, the human hunter 'confronts nature as a subject of social relations…every act of hunting is but a moment in a total process by which social life is carried on through men's collective encounter with nature'. *Nature* as a *subject of social relations;* to hunter-gatherers there is no distinction between a 'human world' and an 'animal' one. Rather, human hunter-gatherer relations with the non-human environment generally take the same form as the principles of sharing within human groups (Bird-David 1992). In this sense, *everything* is shared, *everything* is the social system, and 'the rigid division that western thought and science draws between the worlds of society and nature, of persons and things, does not exist for hunter-gatherers' (Ingold 1999: 409). It should not be necessary to labour the point that to hunter-gatherers, in a social sense, prey animals *are human.*

Human-animal interconnectedness goes much deeper among hunter-gatherers than a sense of ecological sharing. Blurred boundaries between the animal and the human are widespread; for the Ojibwa, for example, 'there is nothing especially "human" about being a human' (Ingold 1994: 24). Their belief systems are replete with references to the animal world, particularly of animals and humans *exchanging roles* and *teaching and providing* for one another (e.g. Anawak 1989). These belief systems usually reinforce this notion of connectedness. To the Chipewyan, for example, humans have their origins in sexual union between a woman and a dog which had the ability to transform into the shape of a human male. Humans and animals subsequently blurred over the course of reincarnations, notably connecting men and wolves (Sharp 1976: 31). Among the Chipewyan, dogs are regarded as liminal creatures, as they eat anything including human faeces and cannibalize their dead. Consequently, they are considered to be inedible, carrying strong associations with illegitimate sexual behaviour and social *disorder*, and function as a metaphor for women and female sexuality (Sharpe 1976: 28). Men, on the other hand, are associated with wolves, due to a 'striking number of similarities between the behaviour and ecology of the two species' (ibid.: 30), a metaphorical expression of the social group, and social *order*. Thus, given the cosmological, ecological and social connectedness of 'humans' and 'animals', the exchange of information between them, the very clear lack of any form of distinction between them, and their participation in the maintenance of social order, it is surely parsimonious to assume that prey animals had just as much social agency to Palaeolithic groups than the individuals that constituted those groups. To put it another way; it would be more anachronistic to assume that human and animal societies were thought to be biologically or socially distinct in the Upper Palaeolithic. What, therefore, might an upper Palaeolithic hunter-gatherer have 'seen' when looking at the animals depicted on the walls of Lascaux? Did they see animals, or part animals/part humans; simply drawings or *real* things?

Palaeolithic art

Art is not essential to the negotiation of social life but it is often a considerably powerful tool in the process. Like group singing, dancing and drumming – it demonstrably promotes prosocial behaviour (Kirschner & Tomasello 2009, 2010), and its floruit during the harsh environments of the Upper Pleistocene is well known (Gamble 1982, 1991). Not that 'artistic' and 'ritual' activity is exclusively connected to social negotiation, however; relationships of inequality are woven into quotidian life, and in many hunter-gatherer groups hunting of prey and subsequent accounts of the hunt are ritual acts in themselves (Sharp 1991: 188). Among the Athabaskan Chipewyan, hunting is an exclusively male domain – women are actively banned from killing game – and the resulting belief system consequently favours males symbolically, leading to a form of gender inequality that has been described as a 'routinised terror' model for half the population (Sharp 1991: 188 and references therein). This particularization of male hunting leads to 'a subtle but competitive *process of ranking* that has implications for social and political relations beyond the household,' (ibid.: 190).

Secret societies and their associated aggrandizer strategies have several key components that strongly suggest that art should be at the centre of social negotiation: the centrality of public displays to their maintenance, often associated with initiation; the prominence of power animals in ideologies and displays related to them; the costly nature of membership; the circulation and use of exotic materials; the use of locations in order to deprive the senses and to place participants in danger; and although not considered here, elaborate burials for members (Hayden 2018: 24, 342). A number of Upper Palaeolithic 'decorated caves' satisfy the criteria for having been used for secret society rituals (Owens & Hayden 2007), and as I discuss below, Lascaux specifically satisfies several of these, justifying its interrogation for social message. The themes of hunter-gatherer art often reflect the complex and entertaining ways that the ambiguous relationship between hunter and hunted is explored in visual culture. If it is fair to assume that similar ambiguities existed in the Upper Palaeolithic, then we might reasonably expect similar content of its art, whatever its direct functions may have been. Among small-scale societies, most symbolic systems are concerned in the main with 'the *relationships* between eating, reproduction, and gender', within which prey form the link between the natural and supernatural relations between the human and animal world (Sharp 1991: 187, my emphasis). In the context of the blurred relationship between 'humans' and 'animals', the latter form a connection in the continuum of humans and the supernatural. No wonder why they are the overwhelmingly dominant theme of Palaeolithic figurative art. We must, therefore, be mistaken viewing Palaeolithic art as simply a representation of prey, whatever its broader 'functions'.

Far from being simply a form of passive representation, Gell (1998) demonstrated how the art of small-scale societies functions as an active process, with a social agency that extends far beyond its physical medium. It is 'a system of action, intended to change the world rather than encode symbolic propositions about it…art objects are social agents (ibid.: 6–7). In this, the act of witnessing is agency, and looking and being seen are social acts. Art forms yet further part of the human-animal-supernatural continuum, and actors are distributed within it, identities blurring through the imitative propensity of humans. In many hunter-gatherer groups it is socially important who makes art objects, and often one finds 'male' and 'female' designs; art, therefore, is often 'entangled with the nature of… gender negotiations' (Conkey 2001: 283–4). Individual identities need not be tied up with single objects or works of art, however; several individuals may have legitimate claim to associations with objects, places, and the events that occurred at them (Myers 1991), although individual works of art are not 'owned' by individuals, even their creators (Keen 1991).

From the appearance of figurative art in the thirty-seventh millennium BP Upper Palaeolithic portable and parietal art demonstrates significant regional variation, e.g. the Aurignacian mammoth ivory carving in the round of the Swabian Alb or pecked and engraved animals of southwest French rockshelters; the Gravettian parietal art of the Lot, contrasting with the widespread 'venus' figurines; and the Solutrean low- and high-relief carved panels in French rockshelters, to name examples which pre-date Lascaux (Conard &

Bolus 2006; Delluc & Delluc 1978; Lorblanchet 2010; Cleyet-Merle 2016). Whatever its variable function, from its inception, Palaeolithic figurative art must have carried cultural signal at the regional metagroup level, and the archaeological record demonstrates an increasing scale of artistic signal over the course of the Upper Palaeolithic. Whether this reflects growing scales of inter-group interaction, or, as Gilman (1984) suggested from a Marxist perspective, an increasingly problematical nature of such interaction, is unclear; whichever the case it is indicative of the increasing scale of signalling over time, which has certainly reached relatively high degrees by *c.* 20,000 BP. If, as Cattelain (2005) has convincingly argued, carved *propulseur* distal parts served as regional cultural markers during the Magdalenian, there is no reason to believe why such social statements about group and individual identity were not also expressed in parietal art. In terms of effort we might view major compositions of parietal art such as Lascaux's art as a form of *primitive valuable* (*sensu* Dalton 1971); *participation* is as much an exchanged phenomenon as physical objects; ''gifts' are treated in Maussian exchange theory as persons…there is scope for seeing art in the same way' (Gell 1998: 9). As human effort was the principle energy (and hence, economic) source of the Palaeolithic (Sahlins 1974: 5) it is surely justifiable to view the production of major works of Palaeolithic art as a form of social exchange: as Dalton (1975: 91–2, 97–8) noted, 'all production processes…require transactions of labor, natural resources and produce…primitive valuables are the means of acquiring superior political…roles in the form of big man status, prerogatives, power, and an entourage of followers'. Furthermore, we should view Palaeolithic art as the product of a shared act of appropriation; 'hunter-gatherers tend to appropriate what they see…[the] metaphor of sharing is a clue to both their views of environment and to their action within it…as human agents appropriate their shares they secure further sharing' (Bird-David 1992). If competitive feasting forms a mechanism for the conversion of surplus into storable wealth, hence creates competition and inequalities (Hayden 1994), why should the collaborative creation of major art panels have not functioned in the same way? Why should we not think of these as forms of social technology in which individual and group signals may be 'stored'?

In the terminology of Wiessner (1983) the theme, style, medium and technique of Palaeolithic art can all carry cultural information of both emblemic (about the group) and assertive (about the individual) nature. In this regard, the relative rarity of human depictions, and the almost ubiquitous animal-like characteristics of the examples that do exist, is of interest. In a consideration of 'wounded/killed men' in cave art, Rousseau (1996) drew attention to the mixing of humanity and animality within single 'zoo-anthropomorphic ' images such as Lascaux's 'Shaft Scene' (itself a confrontation), and the frequent association of such 'hybrids' with themes of wounding and death. Whether or not this represents the act of humans/animals giving themselves to each other in death (ibid.: 207), it certainly reflects a conceptual fusion of the two. Lorblanchet (1989) notably drew attention to the blurring of categories of 'human', 'animal' and 'sign' in cave art, warning that modern tendencies to strict categorization are powerless to grasp the conceptual complexities of such connections using arbitrary concepts, and, however fanciful the language, recognize that Palaeolithic art can represent 'a kind of cosmic placenta, a primeval magma, where all creatures, living and imaginary, merge into formal games…[which] express in symbolic terms the eternal bonds which unite all creatures' (ibid.: 140). It is interesting that, as Lorblanchet (ibid.: 137) has noted, the 'animalization' of the human shape appears in the Magdalenian.

Noting the ubiquity of paired confrontations in Palaeolithic art, Guy (2017: 195) suggested that large panels in parietal art arose as accumulations of successive representations of paired confronting animals, each adhering to an overall compositional narrative in which symmetry was an organizational factor. Confrontations are a particularly common theme in Late Upper Palaeolithic art. Welté (1989) identified 51 Magdalenian examples of confrontation in cave art and 21 portable in the area between the Loire, Rhône, Pyrenees and Atlantic, representing the common prey of the period, i.e. cervids (e.g. Gabillou, Lascaux), horse (e.g. Font-de-Gaume, Les Combarelles, Lascaux), bovids (e.g. Niaux, Le Portel, Gabillou, Font-de-Gaume, Trois- Frères, Rouffignac, Lascaux), caprids (e.g. Niaux, Lascaux) and mammoths (e.g. Rouffignac) and occasionally rarer forms such as the owls of Trois-Frères and birds of Teyjat. The overall frequency of confrontations correlates with the frequency of depictions of each taxon in specific caves; this suggests that when multiple individuals are depicted within friezes – which seem to be exclusive to the Magdalenian parietal art of the Dordogne – confrontation seems to be a major artistic concern. To this list one might add the confronted anthropoid head and horse in the Grotte du Sorcier at St. Cirq (Pigeaud et al. 2012; note also that this cave contains a fusion of a human head and limbs with an otherwise horse body in the form of its engraved 'sorceror' – pers. obs.), two bovids and two caprids in Pair-non-Pair (Delluc & Delluc 1997) and the Lascaux shaft confrontation between a human/animal hybrid and a bison (Aujoulat 2005). Several examples of confronting pairs of groups of animals are shown in Figures 12.1, 12.3 and 12.4.

Considerable attention is also paid to the details of confrontation in Magdalenian art. Postures indicative of fighting behaviour are common to confronting scenes in both parietal and portable art, whether it be the wolves of La Vache, bison of Trois-Frères, mammoths of Laugerie-Haute and Rouffignac, or horses, deer and aurochsen of Lascaux. The frequent presence of submissive postures, however, suggests that these were not fights to the death, but rather the ritualized fighting that ends before mortal wounds can be inflicted (Welté 1989: 230), as one finds among the humans of small-scale societies.

If we acknowledge that art often functions as an active, shared form of social negotiation, promoting social norms through repetitive acts and through which individual agencies can be expressed by skills and provisioning, then its most interesting content is the focus on confrontation and aggression, often in the context of creation (rutting), 'storing' these messages for further elaboration and viewing. It strongly suggests that aggression and inequality are intrinsic to the creation of life and the perpetuation of the social world. What could be more natural?

Lascaux

It may be of note that Lascaux's art seems to have been created at the beginning of a new technocomplex in Southwest France. The end of the Solutrean came somewhat earlier in the region than in Iberia (Straus et al. 2012), probably representing a population break with the succeeding Badegoulian, out of which the Magdalenian subsequently arose locally around 20,500 BP (Ducasse 2012). The few chronometric dates that exist for Lascaux's archaeology (Leroi-Gourhan & Evin 1979; Cleyet-Merle et al. 1998; Delluc & Delluc 2012; see also Gittins & Pettitt 2017 note 1) suggests that its art was perhaps created in at least two phases, between *c.* 17,000–21,000 cal. BP and 21,500–22,500 cal. BP, although taking the paucity of dates measured in recent years and their errors into account these could certainly be consistent with a broad age for the art around 21,000 cal. BP. In comparison to the age range for the latest Badegoulian elsewhere (*c.* 20–21,000 cal. BP), activity in the cave could be entirely consistent with the appearance of the Early Magdalenian. Although some have argued that its art accumulated over several phases perhaps even spaced millennia apart (Bahn 1994), its overall thematic, stylistic, technological and organizational homogeneity is overwhelming (Laming 1959; Geneste et al. 2004; Aujoulat 2005; Delluc & Delluc 2012), and on the basis of its >500 lithic osseous artefacts from its single archaeological level which are exclusively compatible with the Early Magdalenian, and the absence of any artefacts characteristic of earlier or later phases of the Upper Palaeolithic (Allain 1979; Delluc & Delluc 2012) it is parsimonious to date the greater majority – if not all – of its art to the Early Magdalenian/Magdalenian II. This equates to Leroi-Gourhan's Style III (Leroi-Gourhan 1968), and displays in particular a number of strong thematic and stylistic similarities with the smaller cave of Gabillou, although the latter contains mainly engraved art in a much smaller scale than Lascaux (Gaussen 1988). More widely, it forms part of a reasonably well dated group of Parietal art sites (including the caves of Le Placard, Villars, La Mouth, Sous-Grand-Lac) all of which display a strong stylistic inheritance from the preceding Gravetto-Solutrean, e.g. long, uninterrupted dorsal, chest and ventral curves, oval hoofs, a concern with symmetry, and postures indicative of movement and, in Villars, a humanoid/bovid confrontation (Delluc & Delluc 1971, 2012; Gaussen 1988, 1991a, b; Glory & Pierret 1960; Guy 2017: 208).

Lascaux's seven galleries contain painted and engraved panels that constitute a highly organized depiction of several faunal biotopes (d'Huy 2011), five of which contain the bi- and tri-chrome paintings the cave is justifiably famous for (Hall of the Bulls, Axial Gallery, Passage, Nave and Shaft of the Dead Man). Three galleries contain its abundance of engravings (the Apse, Chamber of the Felines, and also in the Nave). Some 70 per cent of the 915 animals still visible on its walls have been identified to taxon, and display an overwhelming iconographic concern with seasonality and rutting among the three dominant species – horse, aurochs and deer (Aujoulat 2005; Pigeaud 2005: 818). Aujoulat (ibid.) has noted several striking aspects of Lascaux's art in particular: the extensive markings throughout the cave system suggestive of deliberate exploration and 'owning' of the cave in the process of 'sacralization'; complex and skilled means to integrate wall form and colour; image morphology and its relationship to viewers; vast numbers of images in uniform concentrations; the numerical dominance of horse where aurochsen visually *seem* to on the basis of size; and a strict order of depiction of horse – aurochs – stags adhered to in all chambers, which follows the seasonal order in which these three species rut. Hayden (2018: 298–9) has noted how the physical nature of the cave, and in particular the differing size of decorated areas, would be fully consistent with the use of the cave as an arena for the activities of secret societies, e.g. with areas of group activity, and areas of seclusion.

A high degree of material provisioning of the cave is attested archaeologically and artistically, notably the clusters of lamps, pigment 'blocks/crayons', stone 'palettes' stained with pigment and a fragment of plaited rope conceivably for climbing (Delluc & Delluc 1979a, b). The approximately 130 stone lamps from Lascaux is impressive alone, and includes the carved and symbol bearing red sandstone lamp and a fragment of a second from the Shaft, each deriving from distant sources in the Charente (Glory 1961; Delluc & Delluc 1979a; Pastoors & Weniger 2011).[3] They are so numerous as to suggest a serious investment in the physical presence in the cave. Distinct mineral pigments were derived from diverse sources, and demonstrate several different production methods of these 'paints' (Chalmin et al. 2004a, b, 2007; Chadefaud et al. 2008); surely we should regard paint production as a form of expertise? The combination of distinct 'paints' in single images is suggestive of a shared endeavour; two distinct manganese sources and production techniques were used in the depiction of the Great Bull, for example, the rare form of one of which (Hausmannite) suggests a source in the Pyrenees some 250 km distant (Chalmin et al. 2007). Considering that each of these two paints were essentially the same colour – black – this can only reflect sharing in both the provisioning and production of the image. Pigment analysis of the two red and black 'back-to-back bison' in the shaft reveals an even greater diversity of pigments from both local and distant sources, and a complex preparatory stage (Vignaud et al. 2006) and considerable diversity of pigment sources and techniques has also been identified for the polychrome 'blazons' of the Nave, and for the haematite and manganese lumps excavated in the cave by the Abbé Glory (Chalmin et al. 2004a).

The act of composition and execution of the depiction of animal groups demonstrates a sophisticated understanding of their appearance, organization, mobilization and activity (Aujoulat 2005). The panels were *accumulated* in an ordered way. Bosses and cracks on the cave's walls that resemble parts of animals were *appropriated* by the artists and incorporated into the depiction of the animal (e.g. the backs and bellies of engraved horses in the Axial Gallery). The depiction of movement ('dynamism') becomes a characteristic of Palaeolithic art from the early Magdalenian (Gaussen 1991a, b) and is particularly prevalent in Lascaux (Pigeaud 2000). Participants in its art become installed into the cave's vibrant and multi-sensory landscape in which the echoing noise of the large chambers reflects the stampeding animals depicted on their walls, and by contrast the silence of the Chamber of the Felines reflects the silent predators engraved on its walls (Aujoulat 2005). We should be careful not to interpret this simply through modern eyes; barbed and hooked signs within and without many depicted animals at Lascaux (particularly predators), rather than representing 'hunting magic', may reflect a tangible fear that the images may have become animated in a 'real' sense and hence, a concern to prevent it (d'Huy & Le Quellec 2010). The bestiary of Lascaux, created with physical difficulty and through a complex, shared material provisioning, becomes something tangible, alive, and dangerous; in short, replete with emotion, a perfect arena for social and ritual discourse (*sensu* Sosis & Alcorta 2003: 268). Many aspects of Lascaux's art are consistent with social signalling, if not specifically costly signalling theory *sensu stricto* (Gittins & Pettitt 2017). Numerous examples reveal that its production incurred personal cost; demonstrates personal fitness or social qualities; demonstrates commitment to the social group through repeated themes and participation in group compositions; and was constrained by social norms (ibid.: table 1). Its scenes are essentially a comment on social organization of prey animals (Guthrie 2005: 7) in which, notably, the human participant is installed *amidst* the cave's cacophonous action.

Given the social concerns of Lascaux's art, it should come as no surprise that it contains much evidence of competition and inequality, as is found among the prey animals depicted on its walls and discussed above. Whether or not we argue that such content was a deliberate signal or whether it was simply a 'natural' observation with no inherent meaning, it is justifiable to note the prevalence of depictions of competition and aggression integral to the art of Lascaux in many other Upper Palaeolithic decorated caves (e.g. Raphael 1954; Laming 1959; Leroi-Gourhan 1968). Particular animals can dominate the mixed grazing scenes of each gallery in one of two ways; they are either *numerically* or *visually* dominant, especially within the same panel. One's eyes are naturally drawn to the two huge confronting bulls that are usually seen as the main organizational principle of the Chamber of the Bulls; they dominate in this sense, but horses are nevertheless far more numerous in the gallery, and in fact it is horses which appear to drive the dynamic scene forward. It is as if horses present a subtle or covert social message within one ostensibly dominated by bulls. Thus, while it is true that the aurochsen represent the culmination of the great, dynamic scene swirling around the upper walls of the gallery, the *real* drive behind the movement are, instead, the horses (including the 'unicorn'[4]) to the rear of each column driving the impressive groups forwards. Socially, this represents two initially incompatible principles; an obvious leadership from the front (bulls), and a subtler leadership from the rear. But if it is correct to take this as an expression of leadership, it divides into leadership by confrontation and by driving, very reminiscent of the instigation of movement and rutting of horse as noted

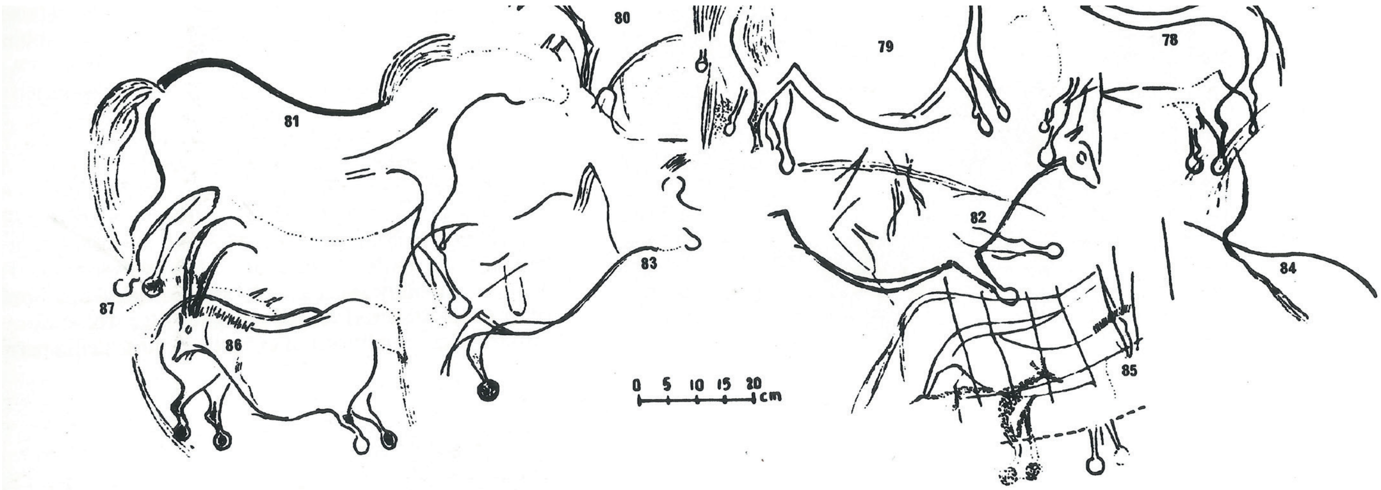

Figure 12.1. *The Abbé Glory's drawing of the engraved horses in the Axial Passage (his inventory numbers 76–87) reproduced in Vialou 1979, Figure 186. The panel demonstrates the principles of line (horses 81, 83, 82), stacking (horse 78 obscures a second) and tiers (horses 81 and 86; 77, 79 and 82). Note also how the dorsal lines of an ibex and horse (which Glory referred to together as inventory number 86), which are opposed (if overlapped), parallel each other. Similarly, the belly line of horse 79 is suggestive of the dorsal line of horse 82. The two front legs of Horse 83 demonstrate the mixing on one animal of two distinct styles; the left is a 'Lascaux style' hoof (round and seen from below like a hoofprint), the right is a 'Gabillou style' (pointed, seen in profile).*

above. It is tempting to relate this to the anchorship of a social core (greater numbers: probably female) and leadership (larger size: probably male) organization discussed above. The process of *driving* is explicit here; in relatively flat terrain horses will generally follow each other in single file – the simplest explanation for the depiction of rows of horses in Lascaux – and in single-stallion bands (i.e. harems) the stallion initiates movement by taking a 'rearguard' position, instigating a forward movement before moving to lead from the front (Pacheco & Herrera 1997). There is much driving evident in Lascaux, although as on its walls horse may drive aurochsen, and stags drive horses, this aspect of its art *cannot* simply be an observation from life on the tundra. In 'real' life; horses do not drive aurochsen, and stags do not drive horses. Why then mix the taxa enmeshed in these social activities unless it is for a statement about the nature of interaction and leadership in a more imaginary social world?

An overall order is expressed in Lascaux's art in several ways; by symmetry, synchrony, and repetition. The symmetrical organization of the panels is clear, i.e. in which one line of animals is 'reflected' or repeated on the other side of the gallery (e.g. the Hall of the Bulls, Axial Gallery, and Nave). Lines of animals following each other – represented for all of the main depicted taxa – express social synchrony (Figures 12.1 and 12.2), as does the repetition of individuals either within (superimposed upon) one another (Which I term 'stacks': Figures 12.1 and 12.3) or placed one above another yet ignoring perspective (which I term 'tiers': Figures 12.1 and 12.4). The near or complete obliteration of some individuals by stacking (shown very clearly in the panel of the Great Black Bull in the Axial Gallery; Aujoulat 2005: 105) shows that this was not an artistic technique, but instead was *meant* to represent a social group, whether or not all animals comprising it remained visible to the viewer. While the superficial order of the compositions reflects a great deal of social synchrony, however, a close reading of Lascaux's panels reveals a striking number of examples of asymmetry (Figures 12.2, 12.3 and 12.4). Among groups, a single individual will often face in the opposite direction to the group; one loner who is breaking from the order. Among opposed groups there is almost always a *slight* asymmetry in numbers, e.g. between horses and aurochsen in the Axial Gallery (Aujoulat 2005: 90). Viewed in the context of the ubiquity of confronting animals, this must surely reflect the fact that things in social negotiations *were not equal*. Can one recognize here alliances between individuals? The sharing of a line between two animals, which blurs the two (to the viewer, where does one end and another begin?) may by an artistic technique to represent alliance, as with tiers and stacks. Why else would these techniques be employed?

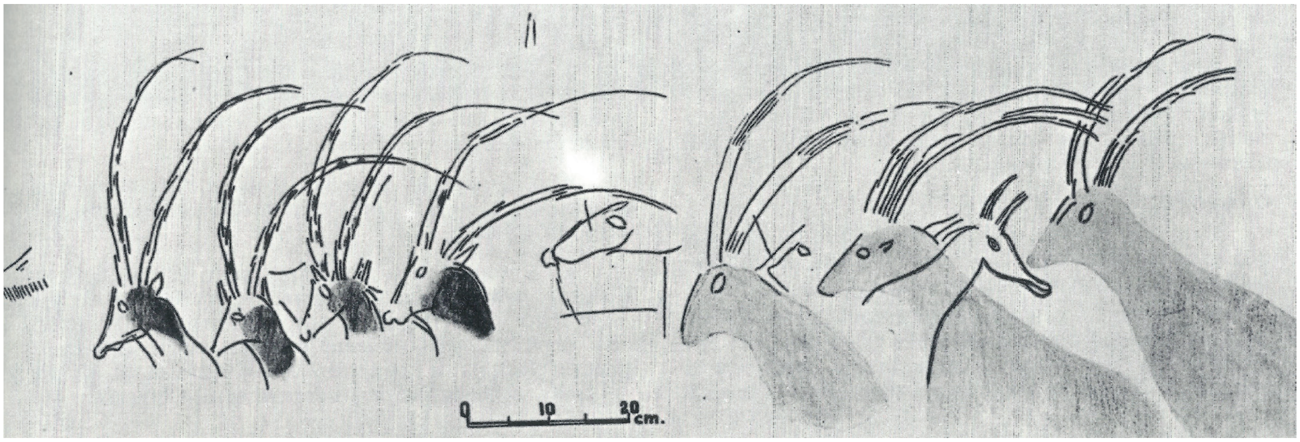

Figure 12.2. *The Abbé Glory's drawing of the painted Frieze of Ibex in the Nave (his inventory numbers 191 (possible head of a horse and 'quadrangular sign' in the centre of the frieze) and 192 (seven ibex), reproduced by Vialou 1979, Figure 218. The entire frieze shown spans about 115 cm. The principle of a line is clear, the horses head creating a slight asymmetry between the front 4 and rear 3 ibex. A single engraved animal at the centre of the rear most three painted ibex is the only one of the group to face to the right; Glory thought it to represent an antelope, otherwise absent from the cave's inventory. This is not the only panel in which confronting animals or a line is split by a quadrangular sign (or blazon). Here, it, and the horse's head with which it is associated, creates asymmetry out of a line of seven ibex within which one could otherwise not identify it. The* symbol *creates an imbalance. Note also the pair of parallel lines above this: see caption for Figure 12.3.*

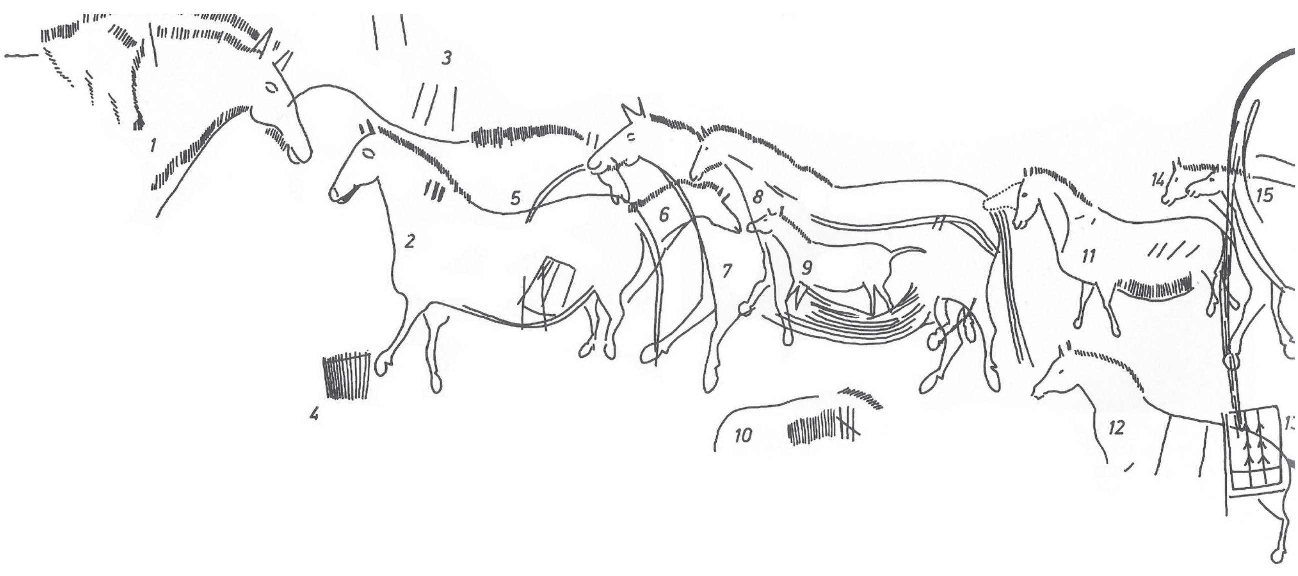

Figure 12.3. *The Abbé Glory's drawing of the engravings of the left side of the Nave's Panel of the Black Cow, reproduced in Leroi-Gourhan 1979b Figure 299. No scale has been provided: the whole panel is over 7 m in length; the section depicted around 3 m. A total of six horses across the panel face right, seven face left; a slight asymmetry, and two confronting pairs are shown. Heavy stacking is evident in the right cluster of horses, the dorsal lines of which parallel each other despite their differing scales. Note that a pair of parallel lines runs perpendicular to the rear hoof of the largest of one of these horses: such paired lines feature among the horses in other panels (see Figure 12.2). Are these paired lines signing something about partnership and wider social organization?*

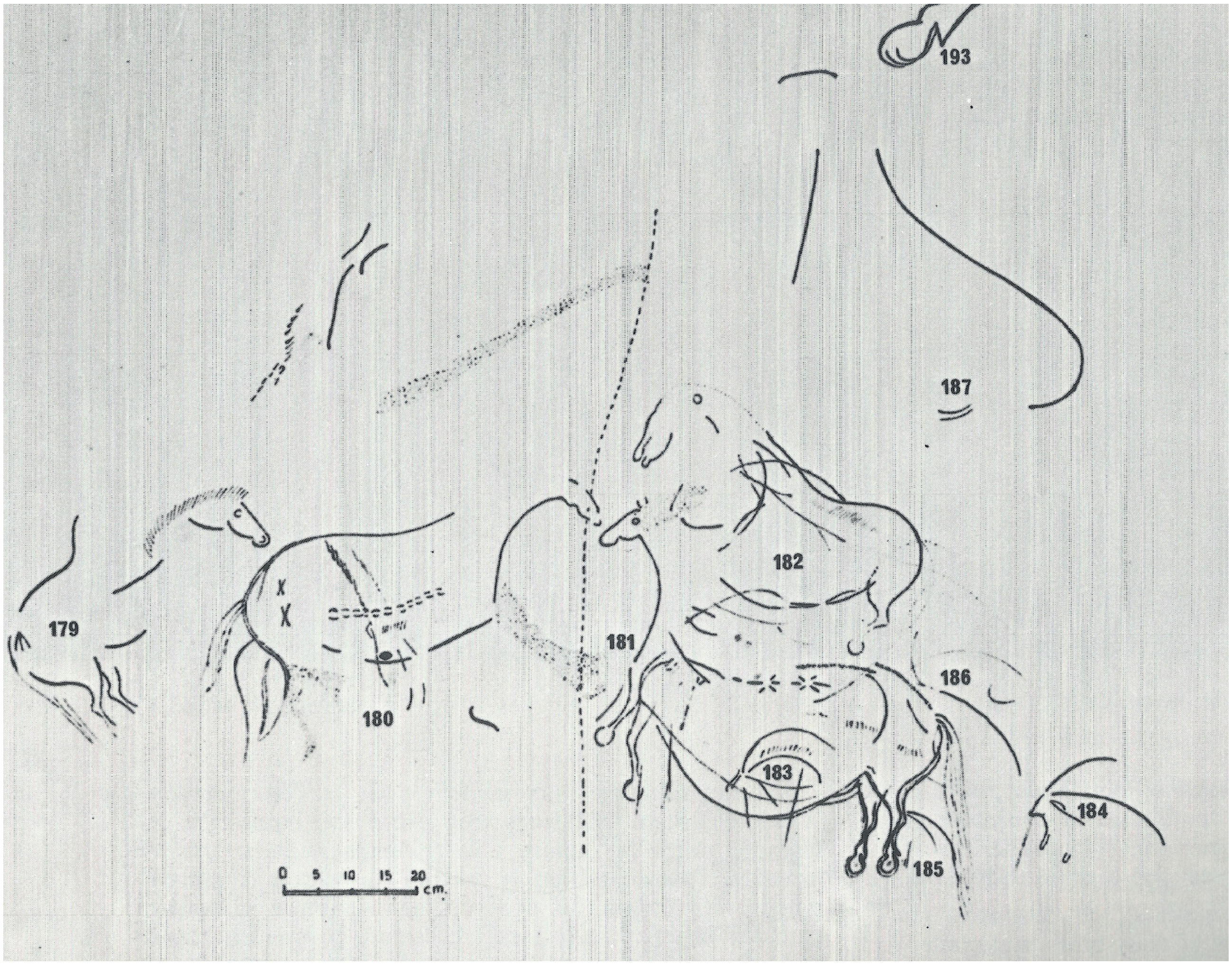

Figure 12.4. *The Abbé Glory's drawing of the engraved horses and ibex of the east wall of the Axial Passage (his inventory numbers 179–87), reproduced in Vialou 1979, Figure 211. A good example of confrontation (horse 180 and 182), a tier (horses 187, 182, 183), slight asymmetry (two right facing horses in the main cluster, three left facing), the panel shows a striking integration of X signs and paired lines on the flanks of Horse 180, and two 'asteriform' signs (Leroi-Gourhan 1979a) that partially complete the ventral/dorsal line of two horses included in Glory's inventory number 181. Note also the line of two ibex heads 183 and 184. Given the effort to engrave these images, why were most incomplete in one way or another?*

Another aspect of asymmetry which one can plausibly link directly to the participation of two social groups is the comparison of Lascaux's art with that of Gabillou, some 40 km to the west and thought to be contemporary. Gabillou's relatively small canon of engravings was probably the work of a small group of artists only (Gaussen 1991b); one might sensibly expect this to be one social group. Like Lascaux it documents a number of aggressive actions among several species, notably the *Cheval qui boit* (Gaussen 1991). In many respects the art of Gabillou and Lascaux are thematically and stylistically very similar; they certainly drew from the same social concepts about order. But there is also a degree of subtle difference, again if one looks in detail at an otherwise strong superficial similarity. Lascaux contains horses with a small number of 'Gabillou type' (pointed) hoofs; by contrast Gabillou contains a small number of 'Lascaux type' (rounded) hoofs (see Figure 12.1 for an example). In each cave these are well contextualized as a *part* of an otherwise homogeneous and ordered panel, and most strikingly, each type of hoof can appear on the *same* animal (Gaussen 1988, 1991a, b; Petrognani & Sauvet 2012). This must surely indicate the contribution of two distinct social groups to the depiction of several examples of single animals in each cave? Additionally, whereas the engravings in each cave are well produced, with skilled and confident lines, numerous animals, while virtually complete and often with great attention to detail, are nevertheless left somewhat incomplete. Dorsal, chest or ventral lines, or legs, bear gaps. Why was this so, if in almost all other respects considerable attention was paid to completeness, naturalness and detail? Was this a factor of shared drawing of images, with breaks marking social distinctions? In this light, the replacement of a missing part of a horse's back by an asteriform sign (Leroi-Gourhan 1979a) is striking (Figure 12.4).

Conclusion

Palaeolithic groups have left no unambiguous indication of their social relationships. We are required to speculate based on the assumption that some aspects of their archaeological record will preserve at least general indications of gross social organization. Taking our clues from hunter-gatherer analogues from the last two centuries, it should be apparent that modern notions of distinct boundaries between individuals and between categories of 'human' and 'animal' are not appropriate for understanding the Palaeolithic mind. Instead, as I argue here, it seems more sensible to assume that such a distinction did not exist, and that the mammalian prey that was so central to the Palaeolithic mentality formed an appropriate model for the organization of human social groups. Following the ubiquity of scenes of competition and aggression in Palaeolithic art – particularly in the spectacular 'supersites' such as Lascaux, it seems likely that social messages about competition and the maintenance of social order were inherent in many works of 'art' and, presumably, in the 'ritual' activities which accompanied their creation. Using Lascaux as an example, I have argued that its art is replete with examples of drivers, anchors, oppositions and confrontations, asymmetries, and several forms of repetition of animals within its dynamic scenes, which I interpret as reflecting deep-rooted concerns with inequality and the maintenance of social order. I have not discussed elaborate Magdalenian burials – often taken as indicative of some form of social rank distinctions (I don't think this inevitable, however) – although if nothing else the impressive array of distinct expertise witnessed in Magdalenian archaeology and in Lascaux alone should make it obvious that considerable *differences* existed between individuals. In Dahrendorf's terms, the question is whether social *differentiation* can be equated with social *stratification* at Lascaux or at any other place and time in the Upper Palaeolithic. The scale of skill-sets demonstrable in the provisioning and creation of Lascaux's art alone cannot, I suggest, be taken to be indicative solely of an ephemeral set of individual differences that made no contribution to a more pervasive social stratification. Why would that result in a very restricted set of burials indicative of some kind of subset of society? I conclude that it is unlikely that such differences could exist in a generally 'egalitarian' group, and while I would not want to exaggerate any inevitability that such would lead to inequality, viewed in combination with the focus on aggression and competition in art makes sense as an indicator of considerable social negotiation between individuals which was constantly in flux. This may not have been social inequality as *we know it;* but it was inequality nevertheless.

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Notes

1 But contrast his comment that 'it may be supposed that there were instances of the ['higher'] tribal level of society in the Palaeolithic era' in which 'unusual' high resource productivity made such exceptions permissible (ibid., 99).

2 I only ignore small furbearers and carnivores here as they are rarely depicted in Palaeolithic art. I am not suggesting that they played no role in Magdalenian conceptions of social ecology.

3 We have perhaps ignored the social importance of lamps, which often carry great symbolism. Mauss (1950) found that among the Eskimo, one lamp was symbolic of one family, whether or not they were used one to a tent in the summer or in multiples by the several families using one winter longhouse. Although one cannot of course ascertain whether a similar pattern pertained at Lascaux, the large number of lamps recovered from the cave's floor in several galleries might suggest that they were brought in by several individuals, and the circulation in the landscape of well-made carved lamps of Charentaise sandstone such as the examples found in the cave's 'shaft'

suggests that these had some social agency, particularly as the more complete example bears a symbol repeated on the wall of the Apse and on a *sagaie* from the cave's floor (Leroi-Gourhan 1979).

4 In my opinion a depiction of a piebald horse – one other of which exists in the cave – drawn possibly with consideration to anamorphosis, correcting the resolution of the animal to the viewer below. It seems to work using the reconstruction of Lascaux IV (pers. obs.). The outline of the animal itself was created by spitting pigment; its two 'horns' were brush-painted on later and hence cannot be seen to be part of the original design (Aujoulat 2005: 68).

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Chapter 13

Naturalism: a marker of Upper Palaeolithic social inequalities?

Emmanuel Guy

It is usually considered that Upper Palaeolithic populations were devoid of any form of inequality or hierarchy. This assumption is based on two main arguments. First, the beginning of a socio-economic divide among individuals is usually attributed to the Neolithic period. The transition towards a sedentary lifestyle induced by agricultural practices and livestock farming may have led to individual ownership of land and excess wealth production. Furthermore, the privatization of those resources by a minority may have caused the gradual establishment of hierarchical societies dominated by casts of hereditary lineages. Traces of the first defensive systems around settlements and of increasingly numerous massacres implying territorial rivalries also date to the Neolithic. The second argument in support of an egalitarian Palaeolithic society relies on ethnological work on numerous Australian, Southern African or Arctic Circle hunter-gatherer societies that show no structural hierarchy. If this egalitarian model is widely agreed upon in the field, it seems to us, on the contrary, that the Palaeolithic artistic data decisively points towards strong social-economic inequalities during that period (Guy 2017).

An art made by specialists

The motivations behind the realism of Palaeolithic representation, their '*naturalism*' – according to art history terminology – are seldom questioned. Where does such a desire for fidelity in the depiction of the visible come from? Even if this mimetic preoccupation seems to concern animal representations exclusively (human figures being both scarce and usually reduced to a far more schematic expression), it is nonetheless robust since it runs throughout the Upper Palaeolithic. This naturalism could be seen as a sign of the probable inequality of Palaeolithic societies for at least two reasons (Guy 2017). The first is that such a level of virtuosity in craft and knowledge is far from self-evident. It seems reasonable that the extremely masterful and complex figurative art in the caves of Chauvet, Lascaux or Niaux bear witness to the long-term practice of drawing, with an artistic education probably started at an early age and necessitating some form of daily practice (Fig. 13.1).

In other words, the high technical level of Palaeolithic figurative representation probably implies some degree of individual specialization. Even on a part time basis, specialization necessarily means inequalities of knowledge. However, differences in ability and skill do not necessarily translate into differences in access to the critical resources for survival, which is key to non-egalitarian social structures (Kelly 2013). Just because one has spent time learning a craft, be it flintknapping or drawing, this does not imply non-egalitarianism in terms of a hierarchy of statuses within the group.

The issue of specialization has been raised previously regarding some artefacts of extraordinary expertise such as Solutrean laurel-leaf points or Magdalenian blades. Jacques Pelegrin argues that the expertise of flintknappers results from a life-long accumulation of knowledge and experience rather than individual specialization (Pelegrin 2007); there is no need to be specialist in order to become an expert. This argument may be asserted for flintknapping, an activity directly linked to the daily quest for means of subsistence, but no economic necessity calls for the act of drawing for which a high level of skill can only be explained by a dedicated training.

A recent study about the manufacture of Aurignacian ivory or soapstone beads emphasizes the great standardization of these productions (Heckel 2017). The author suggests that the uniform aspect of personal ornaments can only be explained by a limited number of production centres and craftsmen. These criteria

Figure 13.1. *Drawing of a bison, Salon noir, Cave of Niaux (Ariège, France), © N. Aujoulat / CNP / MC.*

can be used to define specialization of craftsmen in agricultural societies.

Works of art, stone items or adornments therefore may well have been made by specialists. This division of activities might indicate a form of hierarchy among individuals if we assume that societies needed to be wealthy enough to economically support specialists during their training and their *professional* activity. Such a level of wealth is usually characteristic of hierarchical groups. These claims also speak to the recurring observation that the production of the most imposing Palaeolithic works (among them Lascaux) – which probably required several months of labour – depended upon the economic and material support of the artist by the rest of the group (Bon 2009).

However, it remains speculative whether Lascaux was completed in one effort and whether by being very skilled at an activity, Upper Palaeolithic specialists or experts were supported in the way that court artisans were supported in much later time periods. There are ethnographic instances of individuals who specialized in an activity – flintknapping, basketry, medicine production – in otherwise egalitarian communities (Woodburn 1982).

The second reason indicating the presence of inequality within at least some Palaeolithic societies is tied to the nature of imitation itself: it is not a condition for ritual. One could even say it is the other way around. In traditional societies, art usually presents forms that are much more overtly symbolic than mimetic. This tendency is linked to the fact that in such societies, what is called 'art' is mainly used to communicate with supernatural forces. It has no particular vocation to imitate the real world. When art tends towards illusionism it is generally in order to better serve the interests of an elite because, as Claude Lévi-Strauss wrote, to be able to imitate nature is to show that one can 'compete' with it (Charbonnier 1961). This ability to imitate reality is a source of prestige for both the author and the potential audience of the artwork. Yet, prestige always has a political function. It allows elites to set themselves apart from others and thus contributes towards providing evidence of their entitlements. Artistic imitation therefore represents *added value* which, in addition to the ceremonial or religious function of images, corresponds to economic and political roles. Artistic naturalism is not the only mode of representation used by social elites to express their prestige. However, to my knowledge there are no illusionist artistic traditions in all of art history that are not the product of highly hierarchical societies.[1] We do not see why the Upper Palaeolithic Era would be any different.

Unequal hunter-gatherers

In relation to these arguments, one can legitimately wonder whether distinct social inequalities may have already existed in Upper Palaeolithic societies. The hypothesis is all the more plausible given that the term 'hunter-gatherer' itself covers numerous different economic and social realities. In his work, Alain Testart demonstrates strong socio-economic inequalities among different groups of hunter-gatherers. His study shows that such a social hierarchy, far from being an exception, would instead tend to be the rule among hunter-gatherer groups (Testart 1982). Essentially, Testart believes that there are two categories of hunter-gatherers. The first category lives in desert or marginal resource areas. These groups are usually quite small and mobile, their migrations based on the exhaustion of natural resources. There are no marked inequalities among them and no specific social division. Their organization is close to those of Southern African San, Australian Aboriginal peoples or other groups of humans living in the Arctic Circle.

In contrast, hunter-gatherers from regions with a high biomass show far lower levels of mobility. This semi-settled way of life is enabled by the ability to store wild resources which produces wealth.

Thus, according to Testart, it is not food production itself that led to the emergence of inequalities but rather the storage and ownership of wild or domesticated resources by a minority (Testart 1982). The hunter-gatherer economy of the Northwest Coast Indians is one of the best-known cases. The abundance of seasonal resources, especially the profusion of salmon in the rivers and estuaries during the spawning season, enables the group to store such a great amount of food that they can live at the same site throughout most of the year. These groups are under the domination of a hereditary elite who possess all of the land and resources. Under them are the commoners who possess nothing, or close to nothing; finally, at the bottom end of the social ladder are the slaves who belong to rich dignitaries. The degree of hierarchy and inequality introduced by these stock-keeping hunter-gatherers is not unlike what can be observed in agricultural societies.

According to Testart, the desire to store resources is first and foremost a reaction to environmental constraints. Storage is enabled by *seasonal* resources; the alternation between abundance and shortage is what pushes human groups to keep stocks. The geographical nature of this factor could explain why the majority of hunter-gatherers known to store food are found at high latitudes that experience greater seasonality.

Limited signs of storage

Curiously, hunter-gatherers from regions with limited resources are usually those used as a comparison to evoke the Palaeolithic way of life. Davies (this volume) explicitly rejects the hypothesis that the environment in which Eurasian Palaeolithic groups evolved is comparable to that of complex hunter-gatherers of the American Northwest Coast.

However, the richness of mid-latitude European ice age environments is incomparable to any analogous present-day region (Djindjian et al. 1999). Such a unique ecosystem would be closer to the African savannah than to the tundra or the taiga. Some studies show that the biomass of large mammals of the steppes was closer to the 31,000 kg per sq. km found in some savannahs than to the 300 kg per sq. km usually found in the tundra (Drucker et al. 2014). The environment would theoretically thus have been favourable to an intensive storing practice, but is there any material evidence of this?

There is some evidence but it is rare and difficult to interpret, the most convincing being pits dug in the frozen ground of Gravettian open-air sites located in the plains of Central and Eastern Europe (Pavlov, Dolní Věstonice, Kostienki, Mezirich, etc.). These pits dug close to occupation sites were probably used as pantries, suggested by bone remains of large mammals found inside. Tangible signs of food preservation are not as clear in Western Europe, either because people did not store or because the structures built for that purpose were made of perishable materials that have not preserved (platforms mounted on stilts, baskets, chests, etc.). Another factor is the difficulty in estimating the role of fishing, and more generally marine resources in those economies. Complex hunter-gatherer ethnology reveals that most of these groups are, in fact, fishermen and women. An explanation could be the limited number of steps necessary to preserve fish (gutting, heading, filleting), especially given how well it can be dried and smoked (Testart 1982). Was the coastline intensively exploited by Palaeolithic groups? Were the well-known Mesolithic fisheries first created at that time or had they been there since Palaeolithic times? It is currently impossible to answer this question given the rise in sea level at the end of the last glaciation that resulted in the submersion of the ancient coastline. Any Palaeolithic sites linked to the exploitation of marine resources would now rest a hundred metres below present-day sea level. However, fishing should not be seen as an absolute condition for storage. Populations are known for emphasizing storage of plant food, such as the acorn storing Indians (Pomo, Miwok) from central California. Furthermore, we must consider the possibility of food freezing. For populations living most of the year in temperatures below 0°C it would be the easiest and cheapest way of preserving food (Testart, 1982). It is thus impossible to exclude the fact that storage of game meat could have played an important role in Palaeolithic economies. Moreover, outdoor pits from Central and Eastern Europe seem to suggest it was the case, at least locally.

This brief overview points to the scarce evidence for storage during the Upper Palaeolithic, with the additional issue that these signs do not indicate whether the sites were used to preserve extra food for domestic use or as large-scale storing points that could generate significant economic disparities. However, an increasing amount of data indicates the permanent or semi-permanent occupation of certain large dwellings. In Central Europe, faunal remains found in Krems, Pavlov, Předmostí and Moravany-Lopata II show that animals were hunted throughout the year. Similar situations can be found in southwest Europe. The large Isturitz cave, in the French Pyrénées-Atlantiques region, seems to have been occupied throughout most of the year, with the same for Magdalenian sites in Gironde (southwest France) including Saint-Germain-la-Rivière, Moulin-Neuf and Roc de Marcamps. Such settlements would have been difficult to occupy without food storage, especially during the coldest time of the year.

Ambiguous archeological data

Storage and its consequences for the social organization of prehistoric groups could explain certain unanswered questions. Brian Hayden was the first to clearly defend the idea of the existence of inequalities during the Upper Palaeolithic. In his 2008 book, he points out the ambiguity of large amounts of data that could hint towards the emergence of hierarchy among members of a group (Hayden 2008). Besides signs of storage and sedentism, Hayden underlines the scarcity of burials (approximately 100) found for the whole period and, simultaneously, the richness of some funerary artifacts – such as the spectacular offerings found in the famous Sunghir burials. In elite societies, the burial of dignitaries contributes towards giving a sacred status to the lineage and underlining a family's territory. Hayden also emphasizes the circulation of art objects and personal ornaments over very large distances as a practice usually specific to societies showing some form of hierarchy. The production of food surplus by hunter-gatherers does not only aim at building up a stock of food for winter, but it also creates wealth and reinforces the domination of the owners. From then on, part of the surplus produce, be it food or artefacts, will sometimes circulate over large distances since it allows the elite to buy services and exchange precious goods in order to maintain their prestige – in other words, their social position. Finally, there is a striking spatial overlap of graves and art objects with regions where the biomass was probably extremely rich (Hayden 2008; Guy 2017).

All of these arguments tend to support the origins of a Palaeolithic elite who would have controlled land and resources, in a similar manner to the nobles of the American Northwest Coast.

A heraldic function?

Ethnological data indicate the power of the elite is based on sacredness. The mythic origin of the lineage is the root of any entitlement to land and other people. This idea of heavenly superiority is the basis of social hierarchy. The heroes of these origins stories are usually ancestors who embody the lineage itself.

On the Northwest Coast, the myths involve animals that are sacred ancestors of families of the elite. This animal typology is used to differentiate each noble family and their privileges. The same animals are represented, as on feudal coats of arms, to indicate an identity affiliation. They are sculpted and painted on heraldic masts, on house facades and on numerous ritual artefacts (Fig. 13.2). The use of such visual signs is a constant in this type of society. They allow the ostentatious affirmation of the social rank of dominant families.

If our hypothesis proves to be true, it is possible that Palaeolithic art was used as symbols of identity to communicate the power of elite, making them images of a heraldic nature.

General patterns seen in Palaeolithic art do not contradict this hypothesis, if one accepts their interpretation as follows:

- Primacy is given to the representation of animal species, which have historically been used as emblems.
- The selectiveness of the species represented, approximately 20 throughout the period, prove their symbolic or emblematic function.
- The animals are represented without natural backgrounds and surroundings (plants, mountains,

sky, stars, etc.) and there is no explicit narrative between subjects. This tends to prove, again, that these images are not a realistic or imaginary description of a world but rather are symbols.

- The extreme attention to detail in the depiction of animal species, especially in comparison with those of humans, contributes to the idea that they could have symbolized ancestors and, through them, high-ranking families.
- The scarcity or absence of human representation is all the more understandable if men, or at least a certain category among them, were symbolized by animal species.

Others have mentioned the possible relation between animal species and human identities (Max Raphaël, Annette Laming-Emperaire, Alain Testart) without linking this practice to any form of social hierarchy. The relatively hidden, and therefore secret, nature of cave art could be seen as an argument against the ostentatious nature of an elite. Some drawings found in caves are purposefully placed out of sight in secluded, sometimes barely accessible, areas. The reality is probably more complex. We know that, in addition to cave art, representations could also be present in the open-air, potentially seen by all. One could mention the thousands of engravings that decorate cliffs of the Côa valley in Portugal. It is indeed interesting to notice that outdoor drawings are usually located on river beaches close to areas of crossing and confluence, namely zones rich in resources.

The nature of parietal scenes in underground cave spaces itself is problematic. Studies seem to show that the most accomplished (thus, theoretically most prestigious) representations are found in the largest halls, therefore were susceptible to hosting a significant number of visitors. On the other hand, the more schematic and rough works are usually located in recesses or areas that are difficult to access (Villeneuve et al. 2007). The presence of the works that demanded the most investment in the most accessible rooms can only be explained by a desire to flaunt. The partition of the works in the caves seems to express a desire to impress in line with prestige and distinction strategies that an elite usually employ. One could think that, during the Palaeolithic, families would gather in those richly decorated chambers to take part in ceremonies like the potlatch of the Northwest Coast. The concomitant existence of hidden works is not in contradiction with the existence of an art supposedly dedicated to the elite. Prestige expresses itself both through value attributed to a spectacular iconography and through the existence of confidential works whose private nature produces, by its exclusivity, the desired effect of power. That supernatural access needs to be controlled is precisely the key to the elite's legitimacy.

Figure 13.2. *Interior of a chief's house, Chilkat, Alaska (photo credit: Library of Congress). http://www.loc.gov/pictures/item/2005684854/*

Incidentally, portable art also displays rich decoration, featuring the same animal species as those represented in the caves. It is significant that the most likely sacred symbols one could see as belonging to the group as a whole can be found on personal objects. Personal ornaments can also be decorated with animal motifs similar to those found in the caves. This suggests a personal use of 'religious' symbols (Bon 2009) thus, perhaps, an appropriation of sacredness by a minority which is, again, specific to elites.

Finally, the studies I lead on Palaeolithic modes of representation lead us to recognize the existence of schools, in the sense of the strict repetition of ways in which things are represented from one site to another, across distances that exclude the possibility of their being produced by one individual (Guy 2011, 2017). In concrete terms, this means that the same representational conventions were shared by different artists (Fig. 13.3). This stylistic stability strengthens the hypothesis of an active teaching of image creation at the time. It is highly doubtful that this happened in a totally spontaneous manner. The immersion of artists in the same cultural environment would by no means enable such a unity of styles on its own. It would thus be interesting to question the nature of the thousands of engraved stone plaques found in sites such as the Spanish Parpalló cave, Enlene cave or La Marche in France. The partial and rough nature of the representations they bear could indicate their use as training material for apprentices (Fig. 13.4). However, the stereotypical nature of these representations reminds us

Figure 13.3. *Same stylistic conventions shared in Western Europe around the twentieth millennium (drawing E. Guy).*

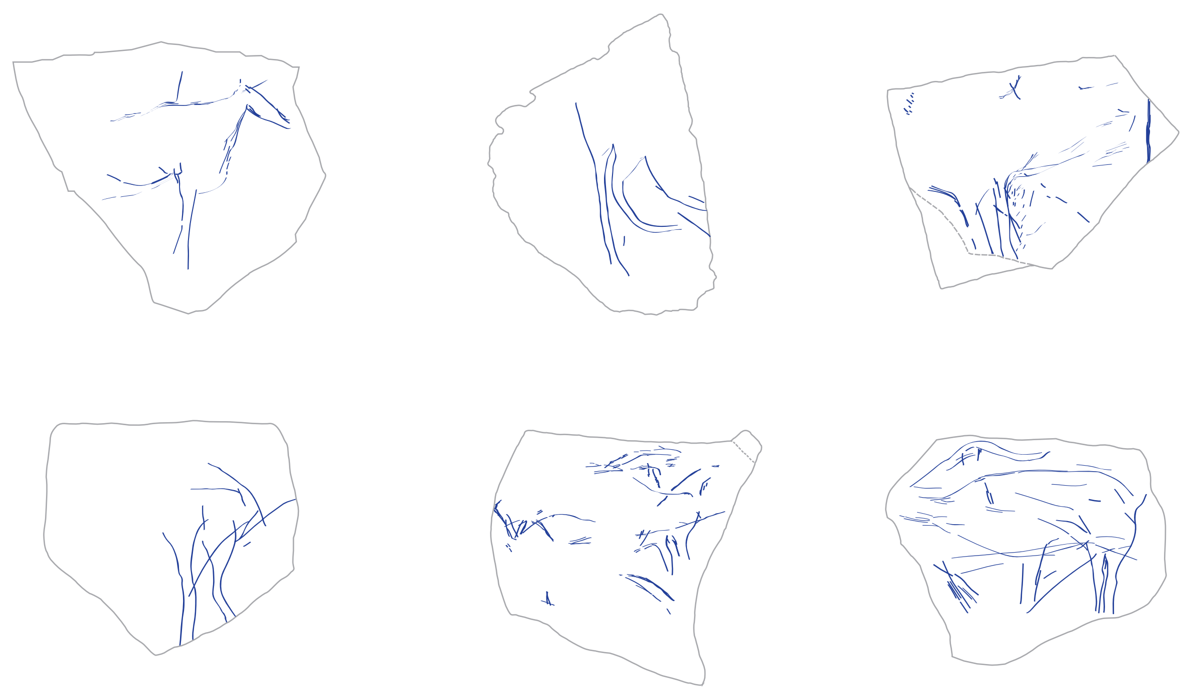

Figure 13.4. *Parpalló cave: apprentice exercises? (drawing E. Guy after Villaverde Bonilla).*

of how important the message these symbols carried must have been at that time. Indeed, we know that the more the image answers a social necessity, the more conventional it needs to be in order to remain understandable for those who receive it. It could thus be considered that such a level of codification could be linked to the transmission of economic or political interests. We have mentioned earlier that long distance trade of objects or rare materials is often a sign of unequal societies in so far as its function is to increase the wealth of owners.

This same logic based on economic interest widely determines the rules of marriage. As Brian Hayden recalled in this conference, it means that matrimonial network exchanges were sometimes built and spread over very large distances. Yet, if long distance marriages can also exist in simple hunter-gatherer societies, they were less common and were not a particular cause of the circulation of goods and images. On the Northeast coast, marriages between sometimes very geographically distant noble families were arranged in order to increase their tangible and intangible assets. (Suttles 1990). Alliances were materialized by exchanges of crests between families commissioned from famous artists (Berlo et al. 2006). These long-distance commissions are the first indication of the geographical dispersion of family emblems. It seems to us that such alliance mechanisms which are specific to elite societies are the best hypothesis for how, during the Upper Palaeolithic period, similar style conventions may have sometimes travelled considerable distances.

Conclusion

In spite of earlier studies including those of Alain Testart, it is surprising to see that prehistoric archaeology still considers economic egalitarianism as the only possible form of social life in the Upper Palaeolothic. Yet, we undeniably know that socio-economic inequalities, at least as developed as the ones which appear in agricultural societies, can exist in hunting-gathering contexts. It is difficult not to see the persistence of a Rousseauist vision in this promotion of the 'good savage'. All of the numerous and troubling pieces of evidence that we have noted above call for caution. Among those mentioned earlier is the artistic naturalism of Eurasian hunting populations, which without doubt, should raise the most questions. First, because their desire to imitate essentially symbolizes in itself the desire for the appropriation of nature which is specific to hierarchical societies. Second, because naturalism inevitably requires at least part-time training and specialization. This is a heavy and constraining investment that could only come from external economic support, which in turn possibly comes from the existence of long-term food storage.

Notes

1. One could oppose our reasoning with rock art from some shelters in the south of Southern Africa. The naturalism of those polychrome paintings is clearly very impressive compared to some masterpieces of the Upper Palaeolithic era. As mentioned before, the San are traditionally part of groups of high mobility hunter-gatherers and their social organization is described as largely egalitarian. However, the reality is maybe more complex than this. The supposed Neolithic age of these paintings also corresponds to burials discovered in the same regions which contain funerary artefacts (painted slabs, tools made of rare materials, ochre, etc.) that were unusual in the context of egalitarian groups (Lewis-Williams 1983). Furthermore, recent studies (Brian Hayden, comm. pers.) suggest that hunters who lived in the region at that time displayed marked inequalities as they occasionally raised sheep and regularly organized banquets for strategic alliances against a backdrop of territorial competition and economic rivalry (Sadr 2005).

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Part III
Social inequality in prehistoric Holocene hunter-gatherer-fisher societies

Chapter 14

Reciprocity and asymmetry in social networks: dependency and inequality in a North Pacific comparative perspective

Ben Fitzhugh

The development or 'evolution' of institutional social differentiation, inequality and complexity has captivated the interest of anthropologists and archaeologists for well over a century. In the last two decades of the twentieth century, recognition of hierarchical or 'complex' hunter-gatherer groups challenged conventional wisdom about cultural evolution and the importance of agriculture in the emergence of social inequality. The purpose of this essay is to revisit behavioural ecological models of the emergence of institutional social inequality within hunting and gathering (or 'foraging') communities and to consider the implications of these models to understand broader (inter-community) social dynamics and histories across regions. This examination is based on comparison of two archaeological case studies from opposite sides of the North Pacific Rim: one from the Kodiak Archipelago in the Gulf of Alaska (supplemented with ethnographic details from the northern Northwest Coast) and the other from the Kuril Islands on the border of the Sea of Okhotsk.

I define 'institutional inequality' as vertical differentiation of status roles and accompanying privileges *codified in cultural norms and sanctioned through the operation of institutions that reinforce them*. The use of the term 'institutional' signifies a qualitative difference from inequality due to individually endowed or achieved variation in skill, charisma and accomplishments that can set individuals apart from their cohorts and even allow them considerable, if temporary, accumulation of power or wealth. Importantly, *non-institutionalized* status differences do not become normalized in social structures, are easily – even actively – reversed, and do not persist inter-generationally. Many primate societies and all human societies exhibit non-institutional inequalities and asymmetries to various degrees. One of the hallmarks of *Homo sapiens* sociality is the ability to suppress and equalize many potential inequalities through collective action and ideological reinforcement (Boehm 1993). The study of institutional inequality is, for many scholars, an effort to understand how and why those equalizing tendencies lose effectiveness in middle-range and larger societies. It is probably also fair to say that an implicit goal of this kind of research for many scholars is to understand how we might support greater equality in the present.

While limited structural inequality, beyond differences by age and sex, likely developed from time to time in the late Pleistocene and early Holocene as described by Brian Hayden (this volume; see also Soffer 1985; Vanhaeren & d'Errico 2005; Wengrow & Graeber 2015), the majority of archaeological examples of persistent inequality are found in the middle and late Holocene (Ames 2007; Richerson & Boyd 2001). This observation may be coloured by limitations in the preservation and identification of relevant correlates of inequality in earlier cases. Nevertheless, most known examples of ranked or hierarchical hunter-gatherer societies appear to have emerged from more egalitarian forms late in the Holocene and are quite rare overall (Price 2002: 418–19). The fishing, hunting and gathering societies of the North American Northwest Coast first exhibit characteristics of structural inequality (large houses, concentrations of wealth, exclusive control of resources, and specialized craft production) about 2600 years ago (Ames & Maschner 1999: 254). The Chumash of the Northern Channel Islands of California begin to show similar signs of persistent inequalities and control over non-kin labour approximately 1300 years ago (Arnold 1996; Kennett 2005: 198). The Florida Calusa chiefdom appears approximately 1200 years ago (Widmer & Widmer 1988; Marquardt 2004). In the Calusa case, large shell mound constructions and extensive canal systems reveal large-scale labour control. While more controversial, other candidates for inequality include the Late and Final Jōmon, *c*. 4300–2400 cal. BP (Habu 2004, 2014), Chaco Canyon, *c*. 1000 cal. BP (Plog & Heitman 2010), Poverty Point, *c*. 3400 cal. BP (Gibson 2001; Ortmann & Kidder 2013) and its antecedents in the earlier 'Shell Mound Archaic' back to 5600 cal. BP (Sassaman 2004). In these and other cases, inequality is inferred from material differences in residential features, differential distribution of prestige/wealth objects, elite burial treatment, labour-intensive constructions such as monumental architecture. Institutionalization of these differences is inferred where these differences persist over time scales of many generations and sometimes where cultural practices, represented in art, ceremonial architecture and other means, reinforce and legitimize social differences.

Efforts to explain the existence of institutional inequality and complexity in foraging societies contributed to a major shift in late twentieth century anthropological thought. Previously, agriculture was seen as the key 'revolutionary' development leading to persistent inequalities and structural complexities. Reassessment of this view followed two contrasting realizations. The first was that ranked and hierarchical foraging societies operated in a number of locations around North America at the time of first European contact and had already been ranked and hierarchical for centuries or millennia. The second was that low-level food producing societies existed for thousands of years *without* significant rank or hierarchy. These realizations forced anthropologists to reevaluate long-standing assumptions about social evolution and to think more systematically about *how* social, economic, and environmental variability could interact and change social structures and the opportunities available to people within them (e.g., Ames 1995; Arnold 1996; Hayden 1994, 1997; Prentiss et al. 2003). The result was a dismantling of simple stage models of social evolution and the shift towards models that recognized multiple pathways to inequality and complexity that paid more attention to ecological processes, historical contingency, agency, and context (Feinman 1995; Feinman & Neitzel 1984; see also Pauketat 2001).

One approach to the study of social inequality derives from a focus on socio-ecological dynamics under the theoretical guidance of human behavioural ecology or HBE (Winterhalder & Smith 2000). Like others considering social inequality from an HBE perspective (Boone 1992; Kelly 1995, 2013; Kennett 2005), I am interested in how socio-ecological configurations can condition potentials for more or less egalitarian vs. non-egalitarian interactions and structures. Human behavioural ecology applies the logic of Darwinian evolution to the explanation of human adaptive behaviour in ecological contexts (Winterhalder & Smith 1992). HBE, like *Marxist* and *practice* approaches, assumes that social agency is, at least in part, motivated by perceived self-interest exercised in inherited social, cultural, and environmental contexts (Fitzhugh 2000). This is the framework in which I first explored the evolution of institutionalized inequality in the Kodiak Archipelago of south-central Alaska (Fitzhugh 2003). In this chapter, I revisit that research to elucidate a case of the evolution of politically ranked hunter-gatherers on the northern end of the North American Northwest Coast. I then turn to the Kuril Islands of the Northwest Pacific and apply similar logic to understand a very different trajectory of social change (Fig. 14.1). These cases are presented to explore key structural factors affecting more or less unequal social relations and how those variables might lead to the institutionalization of status inequalities at different scales and with different consequences for those living within their systems.

Modelling inequality

In recent years, archaeologists exploring processes of social differentiation have recognized that inequalities can emerge under different circumstances and as a result of changes in different variables. From this we have come to question unilineal models and instead seek to better understand the multiple 'pathways to power' (see Hayden 1995; Price & Feinman 2010). One commonality of all or most of the pathways explored is asymmetrical access to resources of importance (food, raw materials, technology, trade routes, labour, defensive ability, etc.). In those cases, some proportion of the population lack (or can be denied) regular, secure access to those resources, while others can control that access. Finally, at least some of the disempowered individuals should be able to do better for themselves by providing services to resource controllers compared to some alternative strategy such as revolting, stealing, or moving away. As long as prospective subordinates can repel or escape dependence on despots, self-aggrandizing can be neutralized. This was, of course, a key insight from classic ethnographic research among hunting and gathering societies in Africa, such as that reported by Richard Lee (1969; see also Wiessner 1996). In intermediate cases (so-called 'transegalitarian', Owens & Hayden 1997), differential influence and status are limited to the ability of would-be elites to provide benefits to potential supporters.

Where options diminish for escaping subordination – perhaps because better alternatives have been claimed by others – the conditions for inequality increase. The degree of inequality should be determined by the relative leverage of would-be elites and supporters in negotiating patron-client relationships. If elites have total control over a resource of absolute necessity and are not dependent on others for different

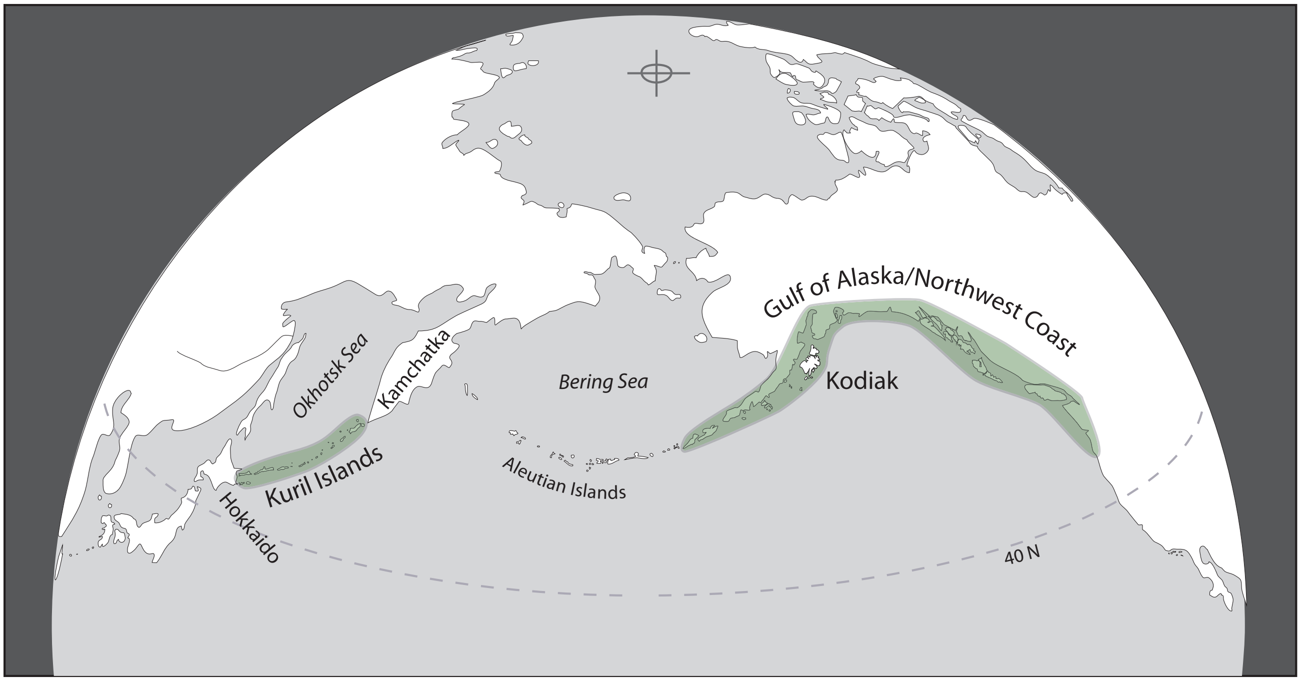

Figure 14.1. *Map of North Pacific showing the North American Northwest Coast, Kodiak, the Kuril Islands, Hokkaido and Kamchatka.*

resources, subordinates have little negotiating power. Their security lies in convincing the elites to support them in return for service, usually labour. If supporters have numerous options and many potential patrons to choose from, they should be able to negotiate beneficial terms in return for their support of elites. The degree of inequality should be more modest.

But on what economic basis do these negotiations turn? Below I will discuss an HBE model for the evolution of inequality proposed by James Boone (1992). It will help to conceptualize the nature of hunter-gatherer inequality with reference to the ethnographic evidence of the northern Northwest Coast.

Inequality of ethnographic foragers on the northern Northwest Coast of North America

At the time of contact with Russian, Spanish, British and U.S. explorers, hunting, fishing and gathering societies from Oregon to the Aleutians were arrayed in ranked and semi-hierarchical social structures. On the Kodiak Archipelago, ethnohistoric accounts from the early contact era (late eighteenth and early nineteenth centuries) document dense settlement, large villages, endemic and organized warfare, resource ownership and intense status competition (Black & Pierce 1989; Davydov 1976; Merck 1980). Many details of the social lives of pre-contact and contact era Native communities around the Gulf of Alaska were lost or suppressed by the time ethnographers arrived to make detailed descriptions (see Pullar 1992, 2001). Active efforts of Kodiak Alutiiq (Sugpiaq) leaders and others in recent decades, with contributions from archaeology among other fields, have reclaimed knowledge about aspects of that past (Crowell 2004; Crowell et al. 2001; Pullar et al. 2013). From those efforts, we understand that pre-contact Alutiiq communities, while linguistically and culturally affiliated with the Yup'ik people to the north, shared many structural features of complexity and inequality with those of Southeast Alaska and British Columbia (the 'northern Northwest Coast'). A review of some of those features is useful as a starting point to establish the range of inequalities present at the time of contact.

According to nineteenth and early twentieth century ethnographic documentation of northern Northwest Coast, ranked societies were organized into complex and nested institutions of inequality and democratic governance. Detailed accounts of Tlingit society by George Emmons, annotated by Frederica de Laguna (Emmons et al. 1991), provide a reasonable approximation of northern Northwest Coast societies, though differences in detail existed from group to group. Astonishing accumulations of wealth and power characterized Tlingit chiefs at the heads of large and resource-rich lineages. Chiefs presided with customary privileges over the productive labours of their households (kin and slaves). Lineages were incorporated into multi-village clans, which were 'led' by a chief elected by the council of lineage chiefs, to manage the affairs of the clan, which itself held no property. In this way, hereditary inequalities were expressed within the confines of the lineage or 'house'. Chiefly lineages rarely incorporated more than the members of a single village. Indeed, some Northwest Coast villages included multiple, independent lineage houses, each led by its own chief, and each with independent territorial claims on resource extraction sites, slaves, and surplus production.

Within house-groups, members were ranked from chief and close kin ('nobles') to low ranking relations ('commoners') and slaves (e.g., Emmons et al. 1991: 21, 37–46). Slaves were derived from war captives and were sometimes traded between regions. They were unranked and technically outside of the lineage system, though they could be incorporated by marriage or adoption – impermanent statuses that could revert at the death of a patron. The status of 'slave' was itself inherited by the children of slaves. The material means of wealth and power – in the form of fishing, hunting and gathering locations, slaves and the collective labour of lineage members – was owned and inherited from chiefs to their close kin. Nevertheless, chiefly power and indeed the relative influence and prestige of lineage houses themselves had to be earned continuously through successful leadership, acts of bravery, and displays of productive power.

Feasting (*potlatches*) was at the centre of status competition between lineage houses, providing both a mechanism to bring glory to the house (and unify its members) and an opportunity to re-arrange relative status of lineages in the larger social order. Actions at potlatch ceremonies could cement alliances or trigger feuds that, in turn, altered political landscapes (Emmons et al. 1991: 46–8). These competitive social performances also provided regular opportunities for elites to size up the competition and to gauge the potential costs and benefits of alliances and conflicts with rival factions. While strategic alliances would have been critical to securing peaceful relations and dominance in trade, warfare provided an alternate form of status competition and another way to change the fortunes of lineage groups. Political leaders paid close attention to potential insults from rivals, as they could be used as levers for retribution claims and war raids, themselves tools for accumulating wealth, labour power, and status.

While approximate rank was inherited in most Northwest Coast societies, the boundaries between commoner and elite 'class' was permeable. Commoners could earn elite status through remarkable prowess, and elites could be demoted to commoner (or slave) status by incompetence, loss of kin support and subjugation in war. Chiefs had to earn the position and were often officially elected to the post by their elite kin, creating rivalries between siblings and cousins. Among the nineteenth century Tlingit, successors were often named by the ageing chief, but to take up the title, the new chief had to pass the judgement of the clan council after demonstrating their ability to finance an expensive feast or project (Emmons et al. 1991: 38–9).

Chiefs and other highly ranked individuals rarely had claim over more than their slaves and the subordinates in their own extended families. With a few notable exceptions (Macquina of the Nuchanulthaht on outer Vancouver island, for example; see Reid 2013), chiefly influence over other communities was limited to the respect and fear they earned as successful potlatch sponsors and war leaders. Most lacked the power to command members of other villages to any particular action.

While we lack comparably detailed ethnographic data from Kodiak, ethnohistoric accounts from the time of early Russian contact indicate that Alutiiq society was similarly organized. Their communities were structured around kin-based lineages with chiefs who owned valuable resource patches, threw celebratory feasts to honour ancestors and mark life events, and waged regular warfare on their rivals, including the Tlingit in Southeast Alaska and the Unangan (Aleuts) of the Eastern Aleutians (Davydov 1976: 22–3; Townsend 1983). On Kodiak successful whale hunters and warriors were revered, and chiefs managed villages of several hundred people (Clark 1984, 1987; Crowell 1994; Holmberg 1985). According to ethnohistoric accounts, the Natives of Kodiak were among the most populous, militaristic, and wealthy of the Gulf of Alaska, and the Russians both avoided and coveted the archipelago for decades before they were able to overpower the islanders and compel the leaders to come under their control (Black 1977, 1992; Knecht, Haakanson & Dickson 2002).

Theorizing human egalitarianism and hierarchy

Two significant archaeological or 'deep historical' questions arise from examples like those of the Northwest Coast and Kodiak. The first is how an elite class could have arisen over the objections of, or at least against the interests of, the majority of members of their communities. The reciprocal question is *why* powerful chiefs were rarely able to break out of the confines of lineal rank-groups to control multi-community polities as was seen in some other fishing, hunting and gathering groups (e.g., Florida Calusa) and countless agricultural ones. Scholars have taken a number of different approaches to these questions over the years, exploring various combinations of environmental, social, and cultural factors and differing in their commitments to comparative generalization versus historical specificity and contingency.

I will argue here that certain aspects of ecological *structure* facilitate and constrain socio-political competition within foraging communities and provide at least partial answers to the two questions posed above, that is how those with aggrandizing tendencies or aspirations may become tolerated, and why their power may be held in check beyond certain degrees of influence.

Drawing from the HBE perspective, I begin my examination with the working assumption that social inequality is conditioned by structural differences in access to essential needs (in subsistence, raw materials, shelter, marriage partners, etc.). Differences can emerge where some people can control access to these resources and where the best alternatives for others is through service to those controlling them. The corollary assumption is that egalitarian relations will persist (or develop) where there is a lack of structural asymmetry between actors because everyone has the potential to acquire needed resources without unequal dependence on others or because everyone is exposed to similar risks of failure. These basic, materialist expectations leave open the possibility that inequality could develop in different kinds of social and economic settings (e.g., foraging or farming) and over access to different kinds of resources (e.g., productive natural resource patches, stored resources, labour, mates, or even symbolic currencies and sacred knowledge where they can be reliably converted into social and material benefits).

While social inequality is, by definition, *social* – it relates to the status of a person or group *in the eyes of the community* – recent cross-cultural study by Smith and colleagues (2010a,b; Bowles et al. 2010) shows that the major differences between more-or-less egalitarian societies and those with heritable inequality are most significantly tied to differences in material wealth. Other axes of inequality – which they gloss as *relational* and *embodied* wealth – also structure social relations in life, but are only weakly, if at all, transmitted. Presumably this is because only material wealth can be dissociated from the individual and exchanged, hoarded, accumulated (potentially without limits) and inherited.

Many scholars have argued that the key to inequality is the willingness of some members of a group to accept and even promote the unequal status of others above their own position. Furthermore, it is widely recognized that egalitarianism is not a natural or primal characteristic of humans (several of our closest primate relatives sustain hierarchical social structures through the achieved dominance of competitive individuals). Where egalitarian relations predominate (always imperfectly), members of society actively reinforce equality through persistent individual and collective action to diminish and discourage self-aggrandizing, wealth accumulation, and assertions of social power and prestige (Ames 2007; Boehm 1993; Woodburn 1982). The structural implications of such collective action are the establishment of institutions – cultural norms, traditions, and practices that reinforce egalitarian social structures (e.g., Endicott & Endicott 2008). The question concerning the emergence of institutional social *inequality* among human communities then is in explaining how such collective policing of egalitarian norms might fall apart and new norms developed that support asymmetric social relations.

Materialist explanations of such transitions often focus in coarse terms on the relationship between population and resource productivity. They imagine inequality to be the outcome of either abundance and relaxation of the toil of resource procurement or, alternatively, a managerial response to hardship, providing increased efficiencies through social coordination (see Ames 1995; Hayden 1995). Both models fail to specify the relevant, strategic relationships between actors in the context of ecological landscapes that I argue is needed to understand how some individuals might participate in their own subordination. In a now classic behavioural ecological analysis, James Boone (1992) combined HBE models into a mechanistic account of how structural inequality might come about. His approach has influenced a number of HBE archaeologists (Kelly 1995; Kennett 2005; Kennett, Anderson & Winterhalder 2006) and was used in my own examination of social change in the Kodiak Archipelago (Fitzhugh 2003).

Boone's model has two basic components. The first relates to the mechanics of social group formation. The second focuses on ecological structure, territoriality, and defence. The size of social groups is often conditioned by the benefits to group members of collective action and the degree to which potential joiners expect to see a significant improvement in their own benefits by joining the group. In the absence of differences in status or power, group members will seek to participate in groups that maximize their own return rates relative to investments. This goal will create conflicts between members and prospective joiners, for whom participation in a group of any size is better than conducting the activity alone. The result is groups that are somewhat larger than optimal (Smith 1981). Theoretically, such egalitarian groups are structured by individual calculations of the relative costs and benefits of joining or allowing others to join a group larger than the optimal group size in which the returns of group membership are divided *equally*. Where interests are calculated strictly on partible shares, profit-maximizing members are expected to resist unequal claims by other members. Joiners, by contrast, might accept lower returns in exchange for shares larger than they would get outside the group, but once members, their calculus would change and they should push for more equal returns.

The members-joiners conflict has implications relevant to emergent social inequality among foragers. First, without industrial technologies, few subsistence pursuits will yield improved per capita returns (economies of scale) in groups larger than a few families, except in rare and short-lived cases such as communal herd drives and net hunting. Put simply, because most tasks reach diminishing returns relatively quickly as the number of participants increase, these groups will normally be small. Second, sizes of task groups and other social units, such as sharing networks and co-residential communities, can be modelled in a similar way based on the relative costs and benefits of communal engagement. Benefits of group membership may be estimated in terms of such variables as economic returns, risk minimization (food security), opportunities for collective labour, and availability of marriage partners. At the same time, members who benefit but fail to invest their share of labour or resources erode group benefits. It is hard to monitor the contributions of others in larger groups, creating social problems (who will pay the costs of enforcing participation?). As a result such conflicts are usually managed by limiting group size (e.g., through fissioning). Third, these tendencies for small groups in foraging societies makes it easier for members to enforce equality through various levelling strategies.

But there are circumstances in which small groups could nevertheless tolerate unequal distributions of benefits. In situations where subordinate members perceive indirect gains from the material well-being of a dominant member, they may tolerate or even support the differential wealth and status of that individual (Vehrencamp 1983). To work, the indirect benefits would have to outweigh the loss in direct benefits. This would be rare in an environment of equal opportunity and risk, but more likely under other conditions.

Boone turns to the socio-ecology of resource competition to complete his argument. Foraging entails the pursuit of subsistence resources that vary in predictability and productivity in both space and time. More evenly distributed resources or those that are unpredictably located in space require flexible harvesting strategies, often by small groups moving frequently. There is little benefit to claiming or defending patches. The same is true for temporally unpredictable prey such as highly mobile, large bodied animals. On the other hand, resources that are predictable in place and timing may be worth claiming and defending where there is competition over access and when territorial defence is practical (resource patches can be circumscribed and controlled). In such cases, the likelihood of competition increases when the environment becomes crowded or resources become scarcer. Competition is also more likely when productive resources are concentrated in widely separated 'hot spots' in an otherwise poor resource landscape (i.e., a *patchy* resource environment). Where predictable and productive resources are patchy, it can be possible and even beneficial to pay the extra costs of defending them from others. This is especially so if the controlled resource can be traded for other resources or labour. Even in a social context in which overt aggrandizing and despotic behaviour is discouraged, the ability to give more often than take will positively skew opinion, influence, and status.

Competition comes in two idealized forms that Boone (1992) refers to as *scrambles* and *contests*. Scrambles are unstructured races to capture a share of a resource. They occur when resources are distributed in ways that cannot be exclusively controlled (sometimes called *Ideal Free Distributions* or IFDs), and these kinds of competitions are won by those with the best ability and good fortune. An IFD is characterized by an unpredictable resource environment that renders previous actions – including position in the landscape – ineffective in ensuring benefits in subsequent competition. Musical chairs and candy toss games are scrambles, in which the best strategy is to target resources themselves rather than challenging others. In IFD ecosystems where the success of individual foraging groups is asynchronous with that of others, sharing is a common mechanism for ensuring mutual welfare (Winterhalder 1986).

In situations in which one actor or set of actors has a historically derived advantage in claiming access to resources, competitions shift to contests, which tend to involve direct challenges to resource controllers. Contests occur where the distribution of resources is patchy and where relatively high-yielding resources are geographically predictable, and where those resource patches or their extracted products (stores) can be defended effectively. Contests supplant scrambles as the best resource patches are claimed and defended. These characteristics define the *Ideal Despotic Distribution* (IDD), and they are ripe for the emergence of resource controllers who take advantage of first arrival or other unique circumstances to control resources and use them to their own advantage. In these situations, controllers often find it beneficial to provide resources to less secure neighbours in return for labour or other services.

The structure of resource landscapes is partly a product of 'natural' ecological characteristics such as biogeographic history, climate, hydrology, etc. At the same time, what matters to foragers seeking to make a living on that landscape is the socio-ecological structure, which is a dynamic relationship between people and that landscape. In low-density populations, resources may be used in proportion to their availability, and competitions, when they occur, will be few and take the form of scrambles. Hostility comes with costs and in many cases, moving to another area is less expensive than engaging in persistent conflict. By contrast, densely packed populations are more likely to find worthwhile the costs of defending their claims or rights to resources. The alternative is to move somewhere that is already occupied by people with stronger claims or to occupy increasingly less secure resource areas. With increased population density, as the highest value and most defendable resources are claimed, other patches may be taken up and defended as well. This will ultimately lead different groups in the region to have unequal resource security. Over time, those controlling the most stable resources tend to fare better than others, and if they have particularly productive patches as well, they will more often be in the best positions to assist the less fortunate. Population infilling thus can turn a previously *Ideal Free* landscape into an *Ideal Despotic* one, simply by increasing the proportion of patches that are claimed, and therein increasing the cost of moving out of a competitive environment. A related characteristic is that higher population densities provide larger numbers of people to assist in resource defence, making previously less defendable patches more defendable – though only if the larger group of defenders can be compelled to collective action.

But population density is not the only variable that can change the perceived structure of a landscape in more (or less) despotic directions. Changes in resource distribution, predictability and productivity due to climate change or over-use, for example, could shift a landscape one way or the other between the IFD and IDD poles. Technological changes will also alter the key variables, for example by changing the relative costs and benefits of food alternatives, increasing defensive capabilities or improving the effectiveness of attacks and raids. Where technologies make it easier to procure less concentrated/ less defendable resources (e.g., snow machines for moose hunting; Winterhalder 1981), the landscape may become less 'despotic'. By contrast, intensification of localized resource technologies (e.g., fishing weirs, nets, buffalo drive lines, etc.) may increase the imperative of defending those facilities or risk losing the investment of labour they required, making the landscape more 'despotic'. Social factors, also, such as the ability of certain people to cooperate on labour-intensive tasks, is also an important, if idiosyncratic, variable in how people 'map' themselves onto the resource landscape.

From behavioural ecological concepts of patchiness, productivity, predictability, group formation, territoriality and competition, we expect that inequality will be more likely when population densities increase and resource landscapes become more patchy and defendable. These ideas have recently been formalized and supported by socio-ecological modellers (Puleston et al. 2014; Puleston & Tuljapurkar 2008; Winterhalder et al. 2015). Prentiss, in particular, has applied this approach with great success to the interpretation of emergent inequality among communities in the British Columbia interior (Prentiss et al. 2014, 2018).

The evolution of inequality in the Kodiak Archipelago

Along the Northwest Coast and Gulf of Alaska, proxies for the transition to inequality include evidence for *competitive feasting*, an expanding market in non-utilitarian *prestige trade*, appearance of *corporate residential units*, and increases in high-risk behaviours, such as whale hunting and warfare – activities tied as much or more to status competition as actual resource provisioning or territorial claims. These characteristics all developed more-or-less in tandem roughly between 950 to 450 years ago on Kodiak, and somewhat earlier in the central Northwest Coast (Ames & Maschner 1999). Interestingly, semi-sedentary residence (indicated by aggregated sod-house villages and use of non-portable site furniture) preceded evidence of incipient inequality (prestige markings, defensive sites, differential mortuary treatment) on Kodiak by more than 2000 years. Technological changes that enabled mass production, storage and potential accumulation of surplus produce – technologies that could have made some resources more defendable and potentially triggered more despotic social interactions – developed even earlier, thousands of years *before* they were put to use for surplus accumulation and wealth competition (Fitzhugh 2003). These facts call into question some models of inequality emphasizing storage as a primary cause of wealth accumulation and status competition (cf. Testart 1982). At minimum, surplus production and storage are supporting but *insufficient* conditions for the development of competitive inequality. In the Kodiak and larger Northwest Coast case additional factors were involved, factors that fell into place between 2500 and 500 years ago.

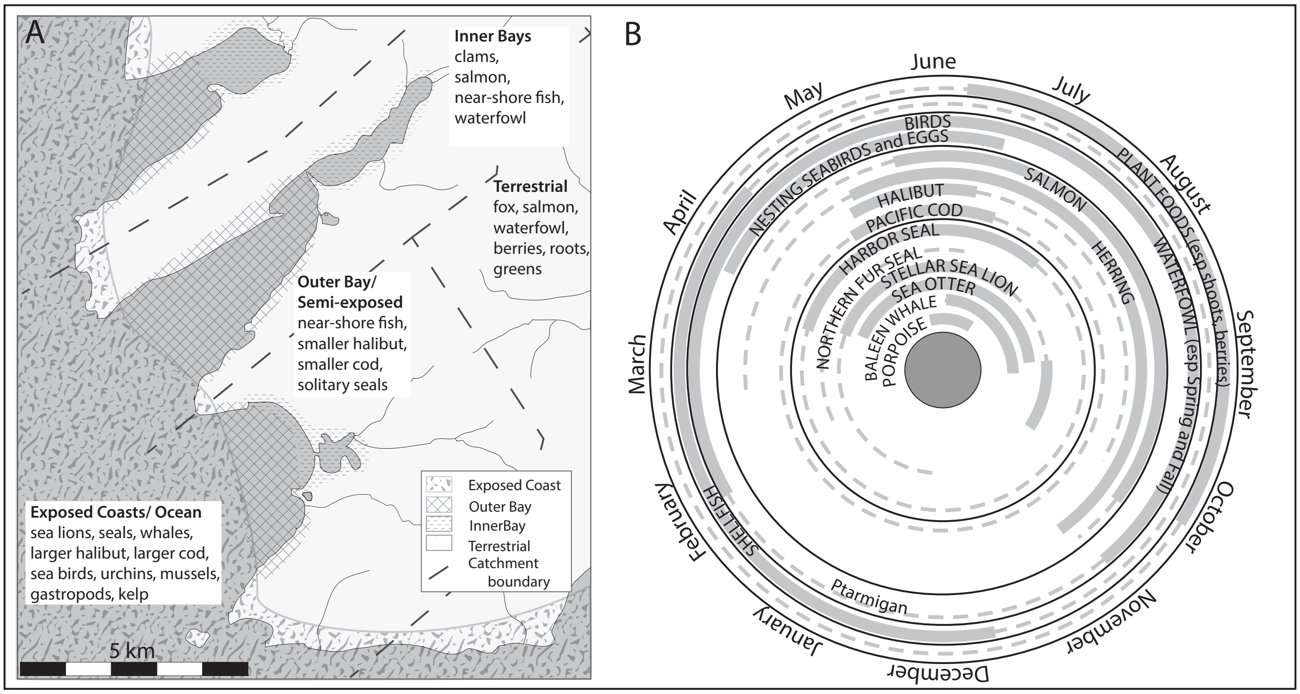

Figure 14.2. *A. Map of part of the Kodiak Archipelago depicting redundant ecological zones. In late Holocene times, with high population packing, each bay hosted its own village each with roughly equivalent access to diverse resource patches. B. Diagram showing seasonal patterns in resource availability and harvesting activities of late Holocene Sugpiaq families (after Fitzhugh 2003, figure 2.10, and Steffian et al. 2015, figure 5.9).*

Like much of the Northwest Coast, Kodiak is seasonally productive, with high habitat and species diversity and patchiness within localized regions, but with redundant habitats and resources diversity when viewed at broader spatial scales (Fig. 14.2). Within heterogeneous local regions, some resources are more prone to failure than others for various reasons (e.g., volcanic eruptions, tectonic events, tsunamis, cooling or warming, storms, ecological regime shifts, human predation or habitat alteration). These impacts can change the availability and reliability of subsistence resources at varying scales. Around the Northwest Coast, numerous strategies were developed to manage environmental unpredictability. These included residential flexibility and logistical mobility, subsistence diversification, technological specialization, and, at least in some areas, substantial habitat engineering (e.g., clam and wapato gardens, herring nurseries, anthropogenic burning; Augustine & Dearden 2014; Hoffman et al. 2016; Lepofsky & Caldwell 2013; Turner & Berkes 2006).

According to the socio-ecological model presented above, Kodiak should not support marked social differentiation as long as people had numerous subsistence options and could move away to other productive regions in times of local hardship or to escape quarrels with neighbours or selfish individuals who could not be managed with other levelling strategies. For this reason and because no resource on Kodiak was so localized that anyone could benefit from its exclusive control, the conditions for inequality were absent as long as population density was relatively low. Based on available, quantitative proxies (Brown 2015; Fitzhugh 2003), population density appears to have been relatively low before 2500 BP (Fig. 14.3C). At that point, we start to see changes in social life that include increased attention to social affiliation, competition for status in life and death, and, eventually, defensive infrastructure, labour intensive habitat engineering, private ownership of resource patches and dense communities organized into households of extended families, ranked by relative size and productive labour-power (Fitzhugh 2003). The archaeological signatures of these changes are discussed below.

Kodiak's Archaeological History

Kodiak was settled by at least 7500 cal. BP by people of the Ocean Bay tradition (Clark and Workman 1979; Fitzhugh 2004). Compared to later occupations, the initial Ocean Bay I phase is characterized by relatively portable tools and structures, and settlement patterns appropriate to flexible logistical forays. While some sites are made up of deep deposits indicating reuse over thousands of years, most Ocean Bay sites are small and thin with only one or a few small, round structures occupied for relatively short periods (Fitzhugh 2002, 2003, 2004; Saltonstall 2014). Beginning about 6000 years ago, in the Ocean Bay II phase, more specialized hunting and fishing technologies came into use, including ground slate points and flensing knives, the first tentative use of nets and of smoke processing features followed sometime after 5000 cal. BP.

In the Early Kachemak phase beginning 4000 years ago, fishing intensified with more abundant use of nets and the adoption of ground slate lances and ulu knives to facilitate repetitive fish processing. Early Kachemak sites (4000–2700 cal. BP) are often composed of dense, greasy black, charcoal-stained sediment from large-scale smoke-processing activities (Steffian et al. 2006, 2016). These characteristics suggest a shift to the production of stored fish and other resources for over-wintering communities. Settlements of the time include durable fishing camps and aggregated winter settlements composed of several semi-subterranean houses, indicating the aggregation of larger numbers of families than were common previously. While new discoveries suggest that some Ocean Bay structures were relatively durable, Early Kachemak houses were more heavily built, excavated deeper into the ground, having more substantial sod walls and roofs. This is expected of residences constructed for more continuous use. More intensive processing and food storage would have made it possible for the first time for communities to form around aggregated 'winter settlements' (Fitzhugh 2002). Dramatic 'Neoglacial' cooling after 5000 cal. BP may have triggered these changes as winter mobility became more hazardous. Interestingly, our population proxy model (Fig. 14.3) does not show population expansion in the Early Kachemak interval despite the intensification of food harvesting, accumulation of seasonal food storage, more permanent settlements, and formation of aggregated communities (Fitzhugh 2003: 210–17; but see Steffian et al. 2016: 307).

In the Late and Terminal Kachemak phases, 2700 to 950 and 950 to 650 cal. BP, respectively (Steffian et al. 2016), we start to see evidence of rapid population growth (Fig. 14.3C), along with expansion of winter villages and more intensive use of salmon harvesting sites. A range of changes suggest accentuation of ethnicity marking (regionally unique labret styles), prestige trade, ancestor veneration and ritual treatment of the dead, and perhaps the beginnings of war-slavery (some burials interred without hands, feet or heads; Simon & Steffian 1994; Steffian & Saltonstall 2001; Steffian et al. 2016). In the Terminal Kachemak, residents started placing houses in defensive positions on small islets and promontories, close enough together to suggest competition between neighbouring communities (Fitzhugh 2003: 186). The hunting of large whales also became important in this phase (Kopperl 2003; Steffian et al. 2016: 309), a high risk activity inherently involving status competition. The method was dangerous and difficult – hunting from kayaks at close range with poison-tipped spears – and we know from ethnohistoric sources, that later whalers were respected and feared for their access to powerful and dark magic (Crowell 1994).

A second phase of social differentiation occurred in the Koniag Period, beginning approximately 650 years ago. Population continued to grow, winter villages expanded, until at contact, some may have included more than 1000 individuals (Clark 1987). At the same time, seasonal fishing and hunting settlements were established throughout the coastal zone, including the exposed outer coast and at the mouth of almost every stream and along the banks of every larger river in the archipelago (Steffian et al. 2015: 49–50). Domestic organization changed as well. In the Early Koniag, after 650 cal. BP, many small dwellings came to be arranged around central courtyards. Then, in the later Koniag phases, courtyards were roofed over, uniting the encircling small structures to form large, multi-family domestic spaces (Steffian et al. 2016: 309). The resulting multi-roomed houses often included separate rooms for related families, a steam-bathing chamber and internally accessed storage rooms, pits, and large storage boxes. The large central room provided a covered space for food processing, craft production and feasting with neighbours or allies as described in contact era documents (e.g, Davydov 1976; Holmberg 1985; Lisianski 1814).

In an analysis of changes in Kachemak and Koniag houses from sites in southeast Kodiak, I found a significant increase in the mean and variance in house sizes through time (Fig. 14.3A). Kachemak houses were universally small, averaging 18–20 sq. m, with a fairly normal distribution. This is expected where people live in nuclear family groups with relatively similar family sizes. No apparent clustering of houses was observed that could suggest corporate organizations larger than the nuclear family. By contrast, Koniag period house varied significantly in size (measured in both numbers of side rooms and sizes of central rooms) with a highly skewed distribution showing many smaller houses and few larger ones (Fig. 14.3A). If residential organization reflects social power – as one might expect when the number of people in one's corporate kin-group plays a strong role in determining

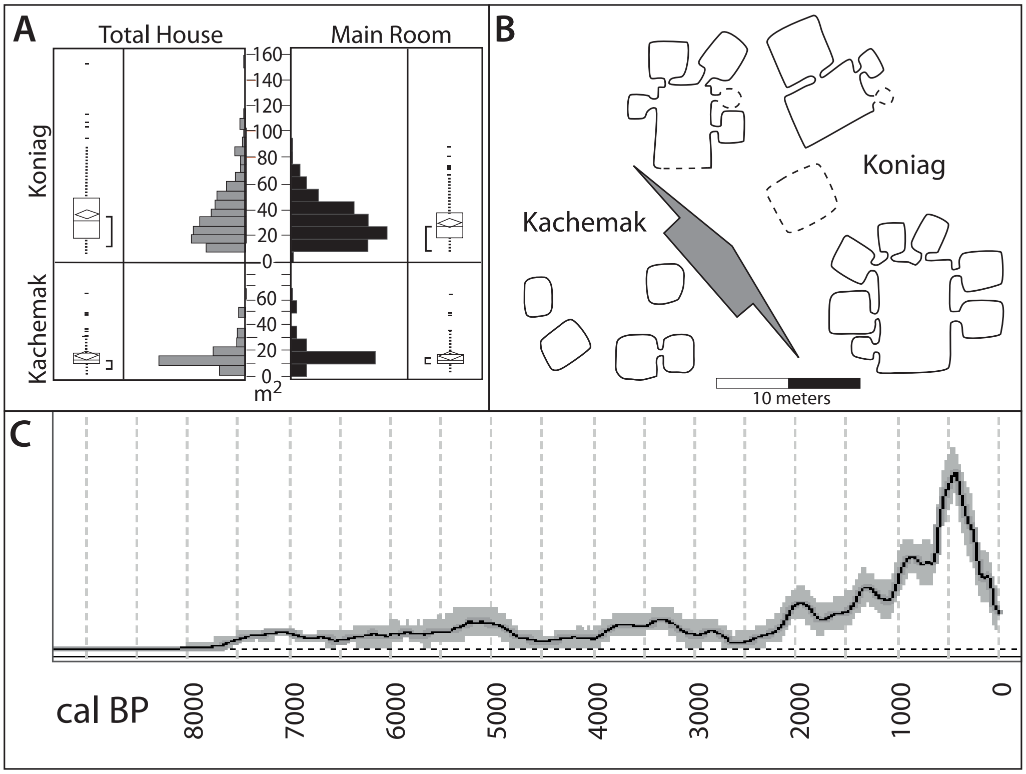

Figure 14.3. *A. Archaeological house area comparisons from Kachemak and Koniag period, measured from surface exposures around the Sitkalidak region of Kodiak (redrawn from Fitzhugh 2003, figure 9.3). B. Plan maps showing representative Late Kachemak and Developed Koniag pit dwellings from Sitkalidak Island, Kodiak (redrawn from Fitzhugh 2003, figure 9.1). C. Kodiak proxy human population model from the Kodiak Archipelago based on the* summed probability distribution (spd) *of archaeological radiocarbon dates. The curve was constructed by William Brown from an effective probability sample size (n) of 200 to 209.6 radiocarbon dates, cleaned and processed to avoid duplicate counting of redundant samples (Brown 2015). The curve is not adjusted to account for taphonomic attrition (Surovell et al. 2009) under the assumption that such global corrections are of uncertain applicability at regional scales, given spatial and temporal asynchronicity in taphonomic biasing factors. This, and similar, curves (e.g., Figure 14.6B), should be viewed with the assumption that dates are under-represented farther back in time. Deviations from the overall accelerating trend represent the patterns of interest.*

the labour power available for accumulating surplus, hosting feasts, defending resources, and launching raids on enemies – then the Kachemak to Koniag transition appears to represent a significant change in the organization of power. The skewed distribution of Koniag house sizes can be interpreted as a change from unranked (or inconsistently ranked) communities to ranked ones, bringing residential organization in line with contact era observations.

Other changes in the Koniag period include the adoption of thick, gravel-tempered pottery from neighbours on the Alaska Peninsula (Clark 1966), probably for rendering oil (Admiraal et al. 2020; Knecht 1995: 375); a short-lived, incised pebble tradition quite similar to sacred stone engravings in the Puget Sound and British Columbia coastal traditions (Clark 1964; Donta 1992), and large scale settlement of Kodiak's larger salmon rivers. At the Kal'unek (a.k.a. Karluk One) site, extensive excavations through the 1980s and in 1995 revealed elaborate ceremonialism, games, and gambling artifacts (Steffian et al. 2015), which may or may not have been new in the Koniag phase (no pre-Koniag site has been discovered with equivalent organic preservation). All of these characteristics can be understood as social mechanisms to help integrate an increasingly competitive social world. The scale of warfare increased at this time with the establishment of larger defensive sites oriented, not to defend from neighbours, but for coordinated, multi-village defence from more distant enemies (Fitzhugh 2003: 196; Knecht et al. 2002). Such was the prowess of Kodiak military that Russian fur traders armed with firearms and ships took 20 years to break into Kodiak and subjugate the warriors and chiefs – and only then through brutal and inhumane tactics (Black 1992). Through the Koniag Period, the data suggest that neighbours held animosities in check and competed primarily through less violent means such as feast competition and displays of wealth and generosity. Gambling was a major winter activity, which could have served both as a marker of 'honest signalling' of wealth (Bliege Bird & Smith 2005) and at the same time a minor form of wealth-levelling between those who could afford to play. Gambling as a social activity in the ranked communities of the northeast Pacific is a fascinating topic in its potential socio-political role, worthy of deeper investigation.

Disagreement persists about the degree to which the Kachemak to Koniag transition on Kodiak was one of internal social change versus one of immigration and influence of Thule-based culture from the north (Clark 1992; Dumond 2009; Jordan & Knecht 1988; Maschner et al. 2009; Mason & Friesen 2017: 110–11; Steffian et al. 2016). These differences are important to the proximate mechanisms that may have driven the development of social inequality in the archipelago. Everyone agrees that some of the material changes noted in the Koniag period have precedents to the north. Pottery, barbed ground-slate end-blades, and sweat-baths are examples, while cold-trap house entrance tunnels, splitting mauls, ridged-slate lance points also could be imported (Dumond 2009: 64–6). From these data and central Yup'ik and Sugpiaq linguistic similarities, Dumond (2009) argues for a substantial incursion or at least influence of northern (Thule-culture) people onto the Alaska Peninsula and into the Kodiak archipelago in the eleventh and twelfth centuries AD. Maschner (2009: 38–41) extends the claim, based on an analysis of radiocarbon dated sites with Kachemak or Koniag attributes, suggesting that Thule/Yup'ik people moved to western Kodiak and then gradually assimilated or took over the rest of the archipelago. Kodiak archaeologists read the record differently, emphasizing that northern elements appear at different times and always in association with Late Kachemak artifacts (Steffian et al. 2016: 311). Steffian and colleagues (2016: 311) note that the cultural attribution of dates through the transition is itself fraught with semantic inconsistencies, largely derived from the use of normative either/or attributions (what Dunnell [1986] called essentialist thinking). Along with the blending of local (Late Kachemak) characteristics and imported ones, house forms appear to have evolved locally with multi-roomed houses appearing first on Kodiak before spreading to the Alaska Peninsula. I believe that the most parsimonious explanation on present evidence is that the Late Kachemak social sphere widened in the early second millennium and that interactions, intermarriage, and cultural exchanges were part of the process of expanding social competition, alliance formation and warfare that characterizes the terminal Kachemak and Koniag periods (Fitzhugh 2003; Fitzhugh & Kennett 2010). However, the migration of 'Thule' people from the Alaska Peninsula, even if it significantly disrupted the cultural continuity of Kodiak occupation, would complicate but not undermine the explanation of inequality presented here. More people, more competition for resources on an environmental of fine-grained patchiness, and the opportunity for some people to gain social advantages by controlling the highest value resources patches would result in either scenario.

We can reflect on some key aspects of Kodiak inequality at the time of European contact and its precedents, the outlines of which are shared, with variations, throughout the Northwest Coast, Alaska Peninsula and eastern Aleutian Islands. First, inequality was limited to the right to control productive resource patches and the labour of subordinate kin and slaves. This inequality became apparent only in the last few hundred years before contact (the Developed Koniag from 450 cal. BP), though it appears to have grown from changes that started two thousand or more years earlier, and may have been accentuated by immigration. The establishment of intensive, delayed-return economic strategies in the Early Kachemak did not directly lead to, but made possible, later population growth (Fig. 14.3C) and incipient status competition in the Late Kachemak, marked by internalized storage, changes in mortuary treatments, intensified ceremonialism, and local defensive fortifications (Fitzhugh 2003). The institutionalization of inequality followed and grew through the Koniag period as seen in the diversity in residential architecture, expanded trade in prestige commodities, militarism and defensive sites, inevitably tied to changing ideologies about the legitimacy of differentiated power and privilege. Second, there is no evidence of coercive power beyond the enslavement of war captives, and, as a result, power would have been limited to the ability of a chief to convince followers to support defensive tasks, participate in slave raids, and work for the production of surpluses. Such demands became imperative only after competition, defence and warfare became endemic in and following the terminal or Transitional Kachemak phase. Third, chiefly status was as much about fulfilling obligations to represent the household in status competitions as it was about the rights to disproportionate personal benefits. This status appears or becomes prominent only in the Developed Koniag with the emergence of unequal sized main rooms for potlatch-style feasts and gambling and the day-to-day activities of enlarged families and slave-labourers.

While behavioural ecologists use terms like despotism in theoretical discussions, it is likely that chiefs were, at most, petty despots, always vulnerable to usurpation by junior members of their lineage or clan. I expect that chiefs could be undercut in various ways: by rebellion from kin, by the defection of supporters to competing chiefs, loss to rivals in battle and raids, and perhaps the collective decisions of leadership councils as was the case among the Tlingit. While some elements of chiefly status would have been inherited, much was achieved, and each chief had to establish their reputation through their decisions, leadership, and proper display of knowledge and skill. In short, chiefs worked hard, and worked for their extended families and villages.

If asymmetrical political power was built on factional politics in the context of high population densities and controllable resource patches, why did chiefs and elite families *not* build multi-village polities typical of many agricultural chiefdoms? I argue that the reason lies in the relative scale of ecological heterogeneity. While productive resources were patchy and controllable at local scales, such was not the case at larger regional scales. Salmon streams, sea lion rookeries, clam beds and fishing holes can be claimed and defended by threat or deed, but if these kinds of patches are repeated from bay to bay and region to region (Fig. 14.2A), no single community could establish a significant monopoly over communities located in other bays or regions. Thus, the relative 'grain' of the ecological patchiness serves as a check on political centralization. Exceptions can be seen in some Northwest Coast cases, where access to particularly lucrative resources could be monopolized over larger areas. When the Russian American Company chose to trade with particular chiefs (*toions*) to the exclusion of others, access to imported goods and colonial influence served as just such a disproportionately powerful resource (Crowell 1997, 28).

Thus the Kodiak case illustrates a dynamic of emergent social inequality in the last millennia, with concentration of power held in check at a particular scale by the socio-ecological redundancy of 'resourcescapes' and intra-/inter-community interactions (Fig. 14.4). Social competition for status among and between kin groups in villages included the ability to accumulate and display non-local prestige goods, acquired through networks of trade (Fitzhugh & Kennett 2010; Knecht 1995: 570). Feasting and trading with neighbouring

Figure 14.4. *Plan view of surface features on a representative 'Developed Koniag' village site (KOD 110) from the Sitkalidak region of southeast Kodiak (A) and map of approximate 'Developed Koniag' village territories around the Sitkalidak region situated to take advantage of redundant ecological zones (B). Dashed lines represent approximate catchment and presumed territorial boundaries.*

elites created alliances that helped to maintain peace and reciprocal support in conflicts with outsiders, providing a deterrent against destabilizing internal conflicts. Warfare, or the threat of warfare, served as a check on potential expansionism. Free subordinates could assess their best options of staying with a patron or moving to a rival group based on the relative security each might offer. Marriage may have served as a primary strategy for redistributing kin into better-off communities without suffering the stigma and disadvantages of refugee status.

It seems likely that Kodiak and the larger Northwest Coast cultural pattern emerged through a kind of 'peer polity' relationship (Renfrew 1996) in which population growth under broadly supportive ecological conditions, and perhaps with arrival of people from outside, triggered increasingly asymmetrical food in/security at local scales. Commoners would have sought the best situation for themselves and would have fled to less despotic communities, ironically increasing the demographic conditions for similar inequalities to arise in their adoptive homes. The autonomy of local communities with internal rank or hierarchy was maintained through competition and alliance at larger scales, gradually increasing the benefits of supporting the political patronage of local elites. Importantly, nothing about this system is predicted by the overall *productivity* or average abundance of subsistence resources. The essential variables are the *differential* security of members of the community and the ability of the more secure to support the less secure in return for other kinds of service (esp., labour). In this case, the scale of inequality is set by the scale at which different families or larger factions experience unequal security over extended periods (see Prentiss et al. 2007, 2012, 2014). Importantly, while a critical determinant of the experience of asymmetrical resource security *relative to* existing economic and ecological contexts, population density is not a fixed variable with respect to inequality. Examples exist, in the hinterlands of the Northwest Coast, of low-density communities with marked social inequality, where some individuals controlled access to valued resources in a way completely consistent with the socio-ecological model proposed here (see Legros 1985)

This model works as well where economic security comes in the form of differential access to food, essential raw materials, trade routes, or vital information flows. The scale of political dynamics is set by the unique socio-ecological and geographic configuration. Larger political aggregations are possible only when the structural dynamics of advantage and disadvantage are such that larger groups and regions can be brought into patron-client relationships, integrated by networks of interdependence. These conditions are more common in agricultural settings when food security can be dissociated from particular landscapes and mobilized through storage, tribute, capture and accumulation. But there are also contexts in which the socio-ecological circumstances dictate local or supra-local equality but regional and macro-regional asymmetry. Applying the patron-client model to those situations helps us understand a kind of socio-political and economic asymmetry that has become more common in our contemporary, globally networked society. To examine the implications of this alternative structure, we turn to consider the late prehistoric and protohistoric Kuril Archipelago.

Case 2: Macro-regional asymmetries: The Kuril Islands

In the case of the Northwest Pacific Kuril Islands, the scales of ecological variability imposed different structural constraints on vulnerability and security, demography and inter-dependence. Late Holocene residents of the Kuril Islands lived in a similar, subarctic, maritime environment as those on Kodiak. They hunted, fished and gathered many of the same foods with considerable skill, using modest watercraft. Like Kodiak residents, they lived in semi-subterranean houses, sometimes organized into small villages, and lived more-or-less permanently in central-places, travelling to procure food and other resources.

With Russian, Japanese, and American colleagues and students, I have spent several seasons surveying, mapping and testing archaeological sites throughout these islands (Fitzhugh et al. 2002, 2016). It bears noting that the archaeology of this region is much less well understood than that of Kodiak. Ethnohistoric documentation suggests relatively egalitarian communities of the Kuril Ainu in the eighteenth and nineteenth centuries (Krasheninnikov 1972: 58–66), but the time-depth of that lifestyle is murky, and discontinuities of occupation history belie any effort to track the long-term, evolutionary history of social organization as I have done for Kodiak. Even so, the archaeological data available offer enough evidence to rule out Koniag-like house size variations, and efforts to estimate contemporaneous settlement sizes (Fitzhugh 2019) suggest few if any Kuril sites were occupied by populations to rival the large, contact-era Kodiak Alutiiq villages of the late eighteenth century.

Kuril Settlement History

The Kurils were first settled in their entirety only about 4000 years ago, with most settlers coming from the Japanese island of Hokkaido bringing cultural characteristics of the Jōmon tradition. This group built up a substantial archaeological presence throughout the archipelago that reached a peak 2000 years ago, in what is known as the Epi-Jōmon phase. By this time, obsidian was traded into the Kurils from both Hokkaido and Kamchatka perhaps in return for sea mammal oil (Gjesfjeld 2019; Phillips 2011). Presumably other resources and marriage partnerships also passed along these trade routes. Even so, the evidence we have from pottery sources and settlement durability suggests that Epi-Jōmon groups lived year-round in the confines of neighbouring island clusters, maintaining broader connections through exchange networks. We have suggested that the obsidian exchange was a reflection of a trade maintained specifically to ensure remote islanders were not socially isolated and cut off in times of local ecological failure (Fitzhugh et al. 2011; Gjesfjeld 2018). For as yet unknown reasons, Epi-Jōmon populations declined from 2000 cal. BP until about 1300 cal. BP when remaining families were forced out or assimilated by a rapid expansion of the unrelated Okhotsk culture.

Okhotsk expansion brought more intensive sea mammal hunting technologies to the Kurils, and the migration may have been motivated to capture marine products for a growing commodities trade fuelled by markets in Manchuria and Japan (Fitzhugh et al. 2016). After expanding rapidly for about 300 years, the Okhotsk then declined precipitously between from 1000–750 cal. BP. Kuril Ainu, themselves descended from Jōmon/Epi-Jōmon probably with some intermixture of Okhotsk, recolonized the islands only after a break of some hundred or more years. The Kuril Ainu were ultimately forced to near extinction, demographically and culturally, during the colonial period, when they became pawns in the growing competition between Russia and Japan (Hudson 1999; Walker 2001).

Based on available archaeological evidence, throughout much of this history, Kuril settlers maintained relatively autonomous economies and domestic units of approximately equal power and status. Evidence to support this claim is mostly negative – the absence of unequal and ranked house size distributions, few if any defensive sites (until the Ainu period), and a paucity of possible prestige items in archaeological assemblages. Epi-Jōmon settlements may have included the largest number of contemporaneous dwellings, while Okhotsk had some of the largest houses (Fitzhugh 2019). Even so, Okhtosk people appear to have moved more frequently (Gjesfjeld 2018), undermining local resource defence. The same lack of intra-community inequality likely characterized those in the adjacent regions of Eastern Hokkaido and Kamchatka. Nevertheless, ecological differences between the remote Kurils and neighbouring territories may help to explain the ultimate instability of Kuril occupations.

Kuril Ecological Structure

If Gulf of Alaska and Northwest Coast ecosystems are comprised of densely packed resource patches of high and variable productivity at a scale conducive to competitive exclusion and patron-clientage, the Kurils are notable for lower overall resource productivity and undefendable patches. Some patches are highly productive (e.g., large sea lion rookeries and sea bird colonies) but are found in highly exposed and sparsely distributed locations. We also don't see any archaeological evidence of intensified harvesting or processing to suggest that subsistence resources were ever converted into substantial stores for the off-season, though it is possible that the Okhotsk produced marine mammal oil for trade (Gjesfjeld 2019). Bird colonies, by contrast, are common and could have been defended, but they are sensitive to harvesting pressure and not worth harvesting most times of the year (nesting season being the exception). Other foods would have been more evenly distributed through the islands, including harbour seals, Atka mackerel, greenling, and sculpin, and these are among the more common foods found in zooarchaeological assemblages (Fitzhugh et al. 2004; Gjesfjeld et al. 2020). In other words, there would be little on which to leverage patron-client relations because the most important resources for food security in most parts of the chain were also the least controllable (Fig. 14.5).

Faunal remains from Kuril assemblages suggest that many communities had access to only a small range of locally available resources, and those resources differed from site to site. Indeed, some of these resources changed from the ends to the centre of the island chain. Clams, salmon, and codfish, for example, could be found only in the northern and southern islands closest to Kamchatka and Hokkaido. Dolphins were ubiquitous at one site in Urup, birds were more dominant at the Rasshua 1 site in the Central Kurils (Gjesfjeld et al. 2020). While some prey may have been abundant most of the time (e.g., sea lions at rookeries), none would have been immune to crisis, and communities would have had to move every few years or decades if not seasonally, and they must have relied, occasionally, on the assistance of neighbours or distant friends.

Within the Central Kurils, these relationships would have been balanced, as any helpers might later find themselves needing assistance from those they had previously supported (Fitzhugh et al. 2011). Thus while the same marine resources are found in the Kurils as on Kodiak, the greater distances between productive patches, the lower predictability of those

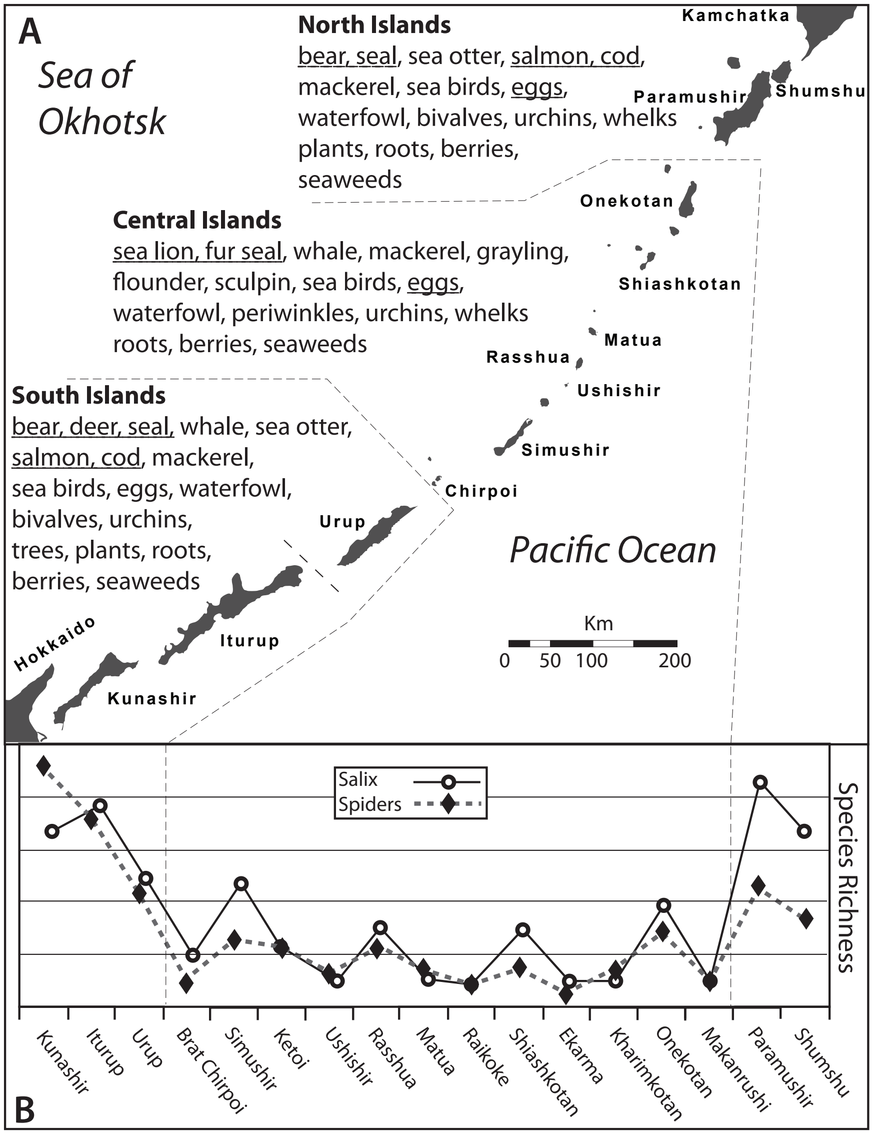

Figure 14.5. *A. Map of the Kuril Archipelago, depicting different ecological characteristics of the North, Central, and Southern Island groups. Underlined taxa are abundant and were economically significant (high ranked). Only taxa used in traditional diets are listed. The central islands, have the least productive, stable, or diverse sets of resources (other than birds), but have had large populations of Stellar sea lion, northern fur seal, and birds.*

patches, and the lack of ecological redundancy from region to region would have worked against any efforts to monopolize patches or attract subordinates from neighbouring families or communities.

Islands near Hokkaido and Kamchatka have anadromous fish streams, support a range of edible shellfish, host terrestrial game like deer and bear, and generally have a modestly higher diversity of habitat types than the central islands. Residents of the proximate islands would have had greater opportunity to travel between the islands and adjacent 'mainland' regions for trade or refuge when things got difficult on the islands. More resource options supported more secure economies and residential stability; but even there, ecological structures should not have been sufficiently unequal to support robust patron-client relations.

If the internal political dynamics in communities across these regions was largely egalitarian, the differences between the central and proximal island regions could have created socio-economic imbalances that may have influenced the serial collapses of Epi-Jōmon and Okhotsk populations. Compared to those living closer to the ends of the chain, the central islanders were more exposed to unpredictable drops in the availability of local resources due to natural hazards, climate fluctuations, or other factors. At the same time, they would have been most confined by storminess and the dangers of boating across inter-island passes. This macro-scale asymmetry in resource security and mobility may have created imbalances in social interactions and dependencies between the more remote islanders and those closer to, or on, the adjacent 'mainland' regions of Hokkaido and Kamchatka.

The archaeology of the Kurils, as we know it, supports the idea that islanders lived in relative insecurity, facing occasionally severe hardships. The long intervals of persistent settlement – through intervals of large and high frequency volcanic eruptions, periodic large earthquakes and tsunamis – suggests that most such hardships were overcome without measurable impact (Fitzhugh 2012). On the other hand, significant depopulation did occur at the end of the Epi-Jōmon and Okhotsk periods, respectively (Fig. 14.6). Both declines occurred during cooler than average periods when storminess and expanded sea ice may have increased subsistence volatility, reduced the ease of boat-based movement, and undermined the ability to call on distant trade partners for help in times of crisis.

If I am right that Kuril settlers were always dependent on access to non-local social networks to mitigate ecological risks at local scales, a proximate mechanism for population decline could have been the emergence of asymmetries in risks and in dependence on each other's trade relationships. With changing climate, those living in areas with greater ecological diversity and economic flexibility would have been less vulnerable to subsistence failure compared to those living in ecosystems with low ecological diversity. In theory, this asymmetry could have created opportunities for potential aggrandizers living in the more 'secure' areas on or close to eastern Hokkaido and southern Kamchatka. These individuals might have sought to establish unequal patron-client relations with more remote islanders, if only the islanders had something of value to offer in exchange.

In the case of the Epi-Jōmon decline, there may have been little of value that remote islanders could bring to their less dependent neighbours, other than more distant items passed on from beyond the chain. It is telling that obsidian traded into the Kuril Epi-Jōmon sites from both directions tails off before reaching the opposite ends of the chain, indicating limited 'flow through' of goods and raw materials (Phillips 2011). On current evidence, it would appear that there was little on which to leverage durable patron-client relations in late Epi-Jōmon times. In the absence of a lucrative trading marketplace, remote Kuril islanders would have been the most vulnerable to ecological crises that affected them more severely than their neighbours. I hypothesize that Kuril Epi-Jōmon populations simply

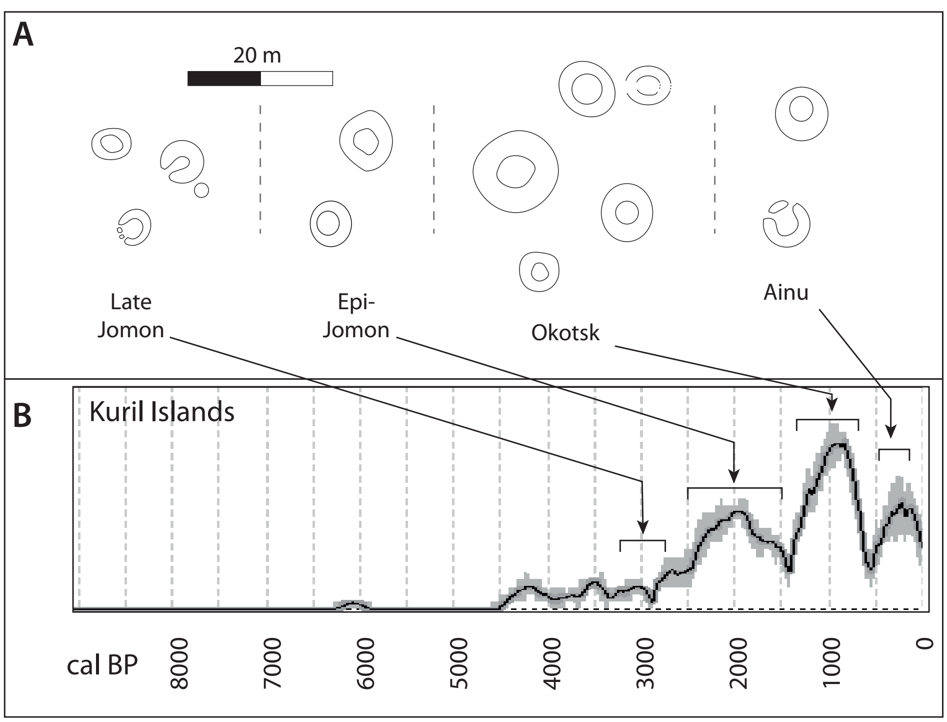

Figure 14.6. *A. House size variation from Late Jōmon, Epi-Jōmon, Okhotsk and Ainu structures (based on data from the Drobnyye 2 site on Shiashkotan Island). Structures are attributed to archaeological phases by radiocarbon dates on associated hearth/floor deposits sampled from soil probes. Structures were mapped at ground surface. B. Kuril Archipelago proxy population curve (Radiocarbon model). See Caption for Figure 14.3C for discussion of assumptions and derivation. Curve courtesy of W. Brown.*

declined gradually as climate deteriorated and islanders experienced more periods of nutritional stress, reduced fertility, increased mortality and perhaps episodic emigration back into Hokkaido.

Then, after about three hundred years of rapid colonization during a warming and drying climate, the Okhotsk in the Kurils disappeared abruptly. This occurred between AD 1100 and 1250 in the early phases of another cooling trend in the Kurils (Razzhigaeva et al. 2013, 2014). This was a time when neighbouring communities in eastern Hokkaido and the southernmost Kurils went through a range of changes that suggest economic hardships, declining populations, and a shifting orientation away from marine pursuits (Ōnishi 2003). In this context, they may have been unable to help partners from an even less secure region. Beginning in the eighth century AD, disinterest towards their island cousins may have been amplified by the simultaneous increase in access to trade for more interesting Japanese goods through contacts with Satsumon neighbours to the south. One reason for the seemingly catastrophic collapse of Kuril Okhotsk populations may have been neglect on the part of Hokkaido Okhotsk as they re-oriented towards Hokkaido social networks. The Kuril Okhotsk seem to have done somewhat better in connections to Kamchatka, where they continued to receive obsidian in trade until their disappearance about 700 cal. BP.

The Kurils were re-settled again, by the Ainu, no later than the sixteenth century AD and maintained trade routes between Hokkaido and Kamchatka. These Ainu settled briefly in Kamchatka, intermarried with indigenous Itel'men (Krasheninnikov 1972; Takase & Lebedintsev 2016), and established settlements or villages on several of the larger Kurils Islands. Even so, they never settled in the higher densities of their Epi-Jōmon or Okhotsk predecessors. At this point well-immersed in the commodities trade, the Kuril Ainu fell victim to political forces and colonial technologies that soon diminished their independence and compelled them to support, alternately, Russian and Japanese economic and territorial interests. Ainu residents of Hokkaido, southern Sakhalin and the southernmost Kurils did develop signs of political inequality, military organization, and defensive fortification, if not slavery. These developments appear tied to control over commodity trade and efforts to repel Japanese encroachment. By the late nineteenth and early twentieth centuries, Ainu in the Kurils, Hokkaido and Sakhalin were dramatically marginalized by the influx of colonial settlers and racist colonial policies (Hudson 1999; Walker 2001). Disease, forced resettlement, and famine led to a final depopulation of indigenous Kuril Islanders in these decades. Despite flurries of military and other colonial settlement through the twentieth century and the continued presence of three modest Russian towns, most Kuril islands are now, once again, largely depopulated and oddly detached from the globally networked world we now inhabit.

Conclusion

In this paper, I presented two case studies to illustrate how differences in ecological structure can interact with demographic economic, and social factors to encourage or discourage institutional inequalities, inequalities that persist for structural reasons and are culturally normalized, socially sanctioned and embedded in multi-generational practices. Following models from human behavioural ecology, I argued that social inequalities at local scales emerge through the confluence of ecological patchiness, defensible resources and social competition. In the Kodiak case, we saw that a productive but locally patchy resource environment could, under sufficiently dense populations, lead to exclusive resource ownership, defence, unequal relations of dependence and the emergence of persistent inequalities. I also argued that the ecological redundancy of this kind of landscape at larger scales served to limit the centralization of multi-village communities into larger polities. From bay to bay, river to river, and cape to cape, neighbouring communities had access to much the same mix of resources, both controllable and not. Before 950 cal. BP, and especially prior to 2500 cal. BP, populations were too low to make resource control viable or necessary, and, as a result, mutual access and inter-dependence prevailed in an egalitarian social context.

The Kuril Island case, while less thoroughly documented archaeologically, shows how similar resources, distributed differently, could inhibit the emergence of inter-personal and community-based inequalities. The critical variables of *productivity*, *patchiness*, and *predictability* failed to line up at any time in the archaeological history of the region. Productivity has always been lower around the Kurils. This may have kept overall population densities low. Some resources appear distributed in predictable patches, but they are not easily controlled and are located far apart, in exposed and hazardous locations. Most staples, by contrast, are more evenly distributed and would have been impossible to control. As with the earlier residents on Kodiak, Kuril Islanders would have always fared better by supporting each other and maintaining extensive trade networks. Even so, macro-scale differences in resource distributions and exposure to ecological risk may have created uneven dependencies between those living in different regions. The resulting asymmetries in trade reliance could have rendered the remote communities unsustainable in deteriorating climates and/or when more secure partners lost interest. If these conditions arose in combination with the expansion of the Japanese and mainland East Asian commodities market into eastern Hokkaido, the combination could have been catastrophic for those trying to persist in remote island settlements.

Put simply, if the model and supporting evidence presented through these case studies are correct, intra-community inequality (interpersonal rank and stratification) is more likely when resource competition is high between factions (e.g., families) within those groups and where the patchiness of defendable resources creates unequal opportunities to leverage those resources for food security and social support. The scale of unequal resource distributions makes a difference in the nature of social inequalities developed. Where asymmetrically distributed resources support inequality at local scales, redundancy can prevent centralization and inequality across larger scales. Alliances and raiding between autonomous communities can reinforce local status inequalities and inhibit the emergence of supra-local hierarchies. By contrast, where local resources are insufficiently defendable, as in the central Kurils, egalitarian relations persist. But where asymmetries in security emerge at regional or larger scales, even where local relations are largely egalitarian, those in the less secure regions can suffer significant impact as the result of the dissolution of support networks engaging more secure partners. I think it is fair to suggest that these kinds of dynamics are less stable than those of local inequality but regional security, and I would predict that culture histories should be punctuated by greater instability where inequities in security occur at regional compared to local scales.

This kind of diffused and impersonal, supra-regional asymmetry in social dependence is broadly prevalent in our modern, interconnected world, a world in which nominally democratic, ideologically egalitarian communities exploit or imperil other communities, often with indifference or, indeed, ignorance. It is the nature of complex socioeconomic networks, too complex to monitor in their totality, that whole communities can be marginalized or lost with little warning or notice. Marginal communities today are those who live with limited access to food security, medical support, legal services, or shelter. Some of these communities are found in remote locations like the Kurils and others live in the midst of thriving urban cores. What they share is a lack of access to the resources and support of people with the interest and ability to help them. Such may have been the case for the Kuril islanders, not just once but twice in the last two millennia, making the islands a good place to study these dynamics.

Of course, some people face greater neglect and insecurity than others in all complex societies, but my point is that these social ills arise as a product of the same structural conditions that, in different contexts, promote the emergence of ranking and hierarchy in 'transegalitarian' societies. There is an abundance of opulence and poverty in the twenty-first century, supported by unequal abilities to control and benefit from highly patchy, monopolizable, and alienable resources. This control is coupled with unprecedented dependence on access to critical goods available only through complex networks, themselves influenced by events both invisible and largely unpredictable to most participants in network interactions.

The comparison of late Holocene developments on Kodiak and in the Kurils provides the opportunity to think broadly about the interplay of food security, population, and social structure. It may even inspire us to find ways to reduce the inequalities and vulnerabilities in our world today just as it gives us insight into the emergence of complex social systems in the past.

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Chapter 15

Exploring fisher-forager complexity in an African context

Joe L. Jeffery & Marta Mirazón Lahr

Contemporary studies of foraging populations[1] emphasize diversity and variability (Kelly 2013). They recognize the spectrum of behavioural, cultural and social adaptations shown by foragers in response to ecological conditions, as opposed to past typological classifications that over-simplified them (e.g. Binford 1980; Testart 1981; Woodburn 1982). Fisher-foragers – those foragers for whom aquatic resources form the predominant food source and focus of economic activity – also exhibit a diversity of adaptive strategies, but surprisingly this new framework has only rarely been extended to them (e.g., Plew 1996), and they are often regarded as outliers with a relatively homogenous set of characteristics (Roscoe 2006; Yesner 1980, 1987). This is partly attributable to chronological trends. With the exception of some early and probably opportunistic instances (Braun et al. 2010; Joordens et al. 2009; Stewart 1994), systematic aquatic resource exploitation (ARE) was a relatively late economic strategy in human evolution when compared to terrestrial foraging; incipient forms are associated with the origin of our species (Marean et al. 2007) and late Neanderthal populations (Cortés-Sanchez et al. 2011; Hardy & Moncel 2011), but evidence of intensive, specialized use, and reliance upon aquatic resources is limited before the late Pleistocene (Erlandson 2001). However, fisher-foragers also gain outlier status for their association with traits more typical of early agriculturalists than the archetypal forager, encompassed by the term 'complexity'.

Indeed, as a concept, forager complexity was conceived to help understand those prehistoric populations for whom the 'small and mobile' forager described at the *Man the Hunter* symposium (Lee & DeVore 1968) did not seem an appropriate model (Price 1981; Price & Brown 1985). Behavioural, social and cultural complexity refers to a suite of interrelated traits that include reduced residential mobility, greater population size and density, economic intensification (usually on aquatic or otherwise plant resources) with associated organizational changes in labour (e.g., occupational specialization), more complex technological innovations, ownership over resources and territories, expanded networks of inter-group trade, greater levels of inter-group conflict, and perhaps most notably, the emergence of social inequality, with hierarchical status differentiation as opposed to archetypal forager egalitarianism (Price 1981; Price & Brown 1985). Storage has also been purported as an important component of complexity (Testart 1982; cf. Morgan 2012), as have factors such as warfare (Fry 2006), slavery (Donald 1997), feasting (Hayden 1994, 1995), monumental architecture (Sassaman 2004), specialized ritual activities and symbolic art (Carlson 1983; Zvelebil 1998). Ethnographic analogues for such complex foragers, however, are relatively scarce, and the indigenous populations of the North American Northwest Coast and the Ainu of Japan are generally considered the best examples (Price & Brown 1985). Of these, Northwest Coast fisher-foragers, whom were particularly well-studied and notable for the degree of complex behaviours and social strategies they exhibited (O'Neill 2014), have come to form the basis of much of the theoretical framework concerning forager complexity (Ames & Maschner 1999: 29). This has, in turn, resulted in an underlying association between specialized ARE and complexity.

There is, of course, marked variability across Northwest Coast foragers, and complex foragers in general, and the aforementioned traits typical of complexity are not necessarily universal to all. Zvelebil (1998) identifies four components of complexity (technological, economic, social and symbolic), each theoretically independently variable. It is the social aspect (i.e., social inequality), however, that is fundamental to many scholars' concepts of complexity (Arnold 1996; cf. Paynter 1989), spurring a range of terminology to describe complex societies with regards to degrees of social inequality (e.g., tribes, chiefdoms and states, or transegalitarian, ranked and stratified; see Ames 2008: 490). Others eschew the term 'complex' as an outdated, dichotomous classification, carrying tenuous implications of comparative advancement or superiority to 'simple' egalitarian societies, as well as drawing attention away from social inequality through its corollary implications of economic, technological and perhaps symbolic complexity (e.g., Kelly 2013: 242, who prefers 'non-egalitarian'). Despite these caveats, 'complexity' is used here nonetheless, precisely *for* its more inclusive implications of the whole suite of aforementioned interrelated traits, as a useful tool for assessing the extent to which these traits have been accurately associated with a fisher-forager subsistence (e.g., Ames 1994; Yesner 1980, 1987).

We argue that this common association stems from a biased ethnographic and archaeological record, dominated by fisher-foragers from exceptionally productive and predominantly higher latitude (≥40°) marine coastlines. This bias disregards one of the most geographically and temporally widespread prehistoric fisher-forager traditions – the African Aqualithic, which flourished during the African Humid Period (AHP; 11,500–5,500 years ago; deMenocal & Tierney 2012; Yellen 1998). This tradition is distinct in that it is found along fresh, inland waterways rather than marine coastlines, and entirely below 40° latitude, and thus sets a unique comparison with the sociocultural attributes of the well-known higher latitude fisher-foragers. The following sections discuss the evidence and theory behind the association of fisher-foragers with complexity, before quantitatively testing this association using a cross-cultural ethnographic sample that includes both low (<40°) and high (≥40°) latitude populations. We conclude the paper with a discussion of the African Aqualithic tradition, with a focus on chronological and geographical trends that throw light on the question of fisher-forager complexity, particularly in terms of social inequalities.

The fisher-forager complexity paradigm: a high latitude bias?

There is substantial evidence to support an association between ARE and forager complexity. Ethnographically documented fisher-foragers tend to have low residential mobility and high population densities, often attributed to the exceptionally concentrated, rich and diverse resources of certain coastlines (Day et al. 2012; Roscoe 2006; Yesner 1980, 1987; cf. Osborn 1977). This, alongside the geographic and temporal variability of resources, promotes labour reorganization for efficient economic intensification, territoriality, and ownership (Ames 1981, 1985, 1994), and the accumulation of surplus (Morgan 2012; Testart 1982), which can be used in trade and feasting (Hayden 1994, 1995). However, these well-established associations between ARE and forager complexity need not be universal. As a strategy, ARE has multiple ecological, demographic and economic potential alternatives, each of which could have different consequences towards behavioural, social and cultural complexity. Such alternatives have been little studied, largely because the ethnographic record is biased towards certain fisher-foraging societies.

Figure 15.1 illustrates this geographic bias in three major cross-cultural datasets of ethnographically documented foragers (Binford 2001; Kelly 2013; Marlowe 2005)[2] – as is indeed recognized by their curators. North American populations are vastly better represented than other continents (Fig. 15.1a). Only the Australasian sample comes close to that of North America for relative landmass area (Fig. 15.1b), while Asia, South America and Africa are comparatively poorly represented. This distribution reflects only that of foraging groups recorded upon European colonial expansion who were not already assimilated by (typically economically dominant) agricultural societies – and so often occupied, or had been forced into, marginal or unarable habitats – and who were recorded in sufficient detail for meaningful cross-cultural analyses. This bias is even more pronounced among fisher-foragers. Figure 15.2 plots only those 117 populations classified as fisher-foragers in Binford's (2001) dataset, as well as crudely distinguishing the presence of social inequality – whether each population is egalitarian or non-egalitarian – based on Binford's variable 'system state'.[3] Three features of Figure 15.2 are notable: (1) both egalitarian and non-egalitarian fisher-foragers are found across all continents, except Africa where they are unrepresented, while (2) the vast majority of documented fisher-foragers come from western and especially northwestern North America, which (3) is also the only area with a clear absence of egalitarian fisher-foragers (the adjacent high latitude coasts of eastern Asia and southern North America/central America show similar indications, but with relatively small samples).

These exceptionally well-represented Northwest Coast populations that dominate fisher-forager datasets have shaped our interpretation of adaptations towards ARE. Indeed, established relationships between ARE and low mobility are based on a small sample, heavily biased towards Northwest Coast populations (Kelly 1983: 292; 2013: 90; but see Roscoe 2006). They also underlie ecogeographic patterns in forager diets, which show the increasing importance of aquatic resources away from the equator, especially above 40° North

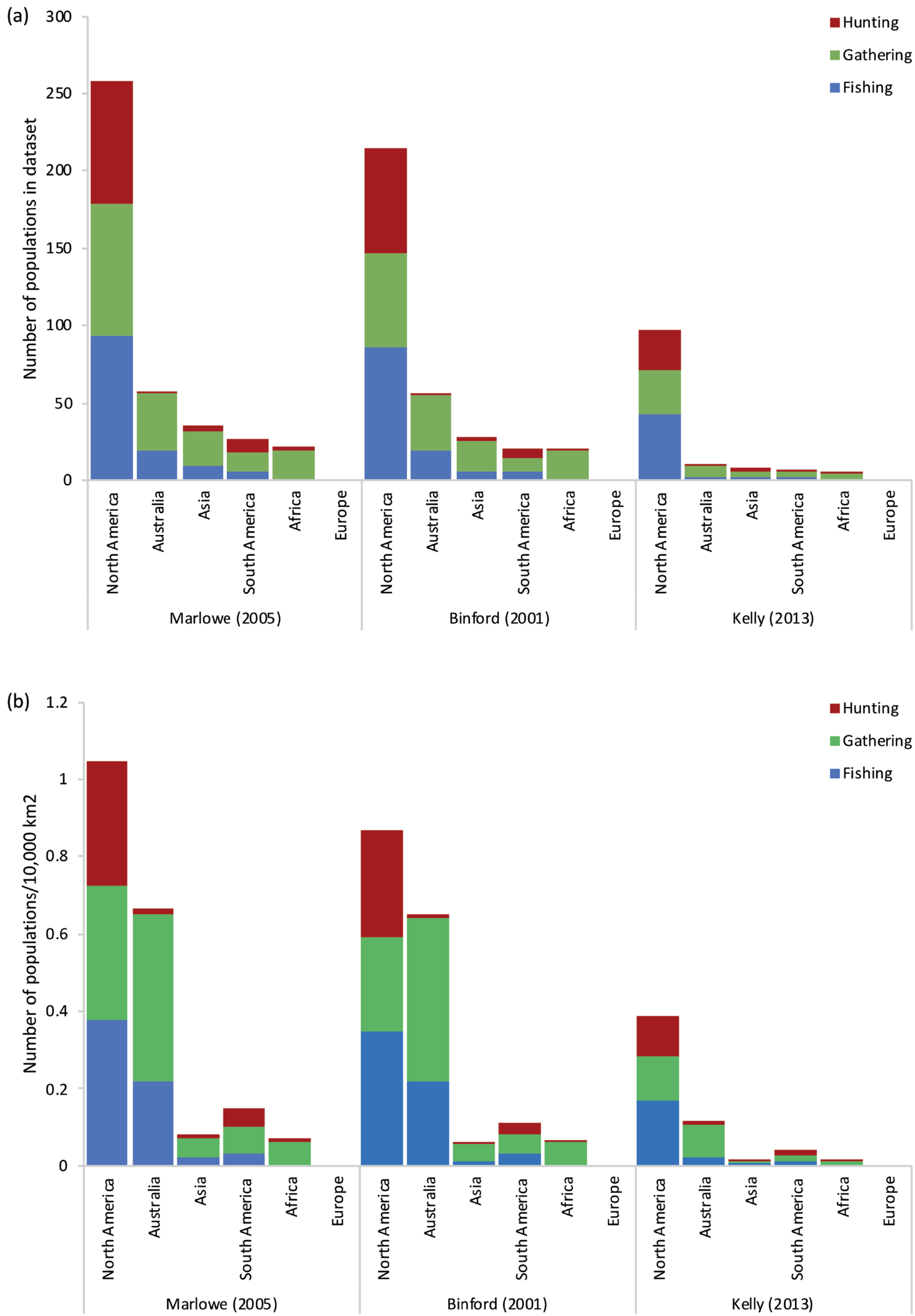

Figure 15.1. *A comparison of forager representation across six continents by number of populations (a) and number of populations per landmass area (b), in three large cross-cultural forager datasets (Binford 2001; Kelly 2013; Marlowe 2005). Summary statistics reflect primary subsistence type (hunted, gathered or aquatic resources).*

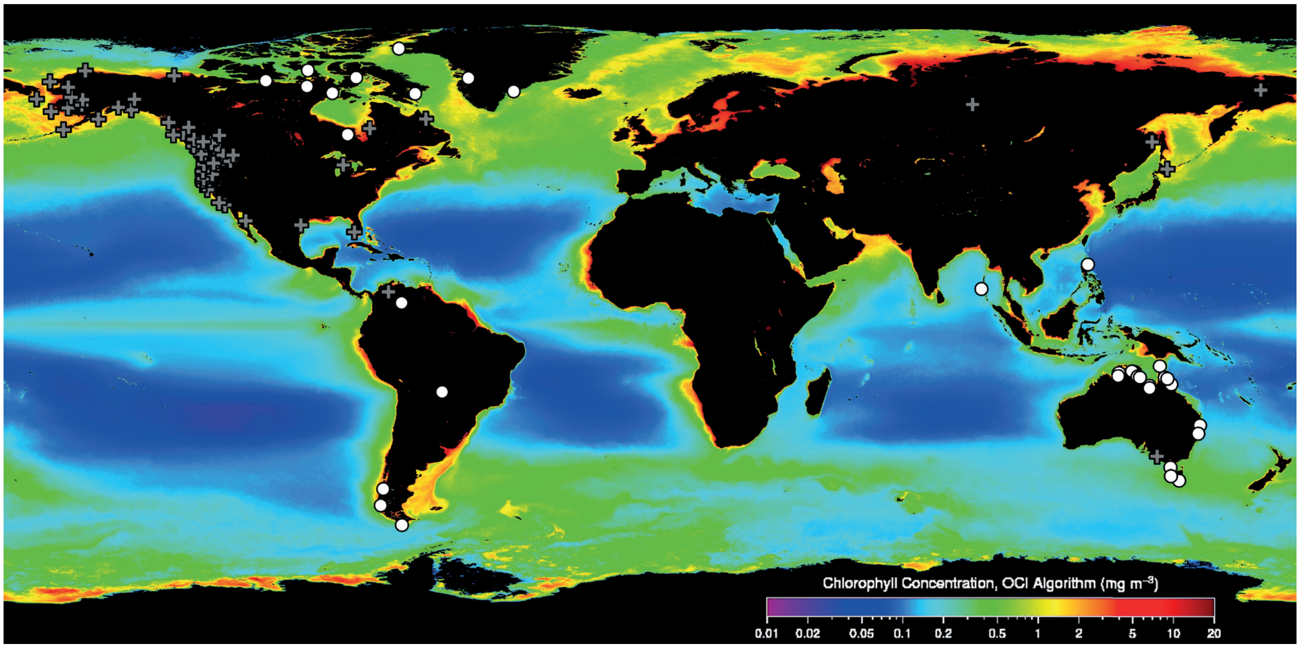

Figure 15.2. *Fisher-foragers from Binford's (2001) dataset, distinguished as egalitarian (white circles) or non-egalitarian (grey crosses) based on the variable 'system state' (*[systate3recod]*, see Table 15.1 and Note 3), plotted over ocean chlorophyll a concentrations (4 July 2002–30 November 2018 composite data; NASA Goddard Space Flight Centre, Ocean Biology Processing Group 2014) as a proxy for marine productivity.*

(Cordain et al. 2000; Lee 1968; Marlowe 2005). It is also from Northwest Coast fisher-foragers that much of the theoretical basis concerning forager complexity is derived (Ames & Maschner 1999: 29), building an inherent association between social inequality and ARE. The underlying factors shaping ARE among Northwest Coast groups, revolving around local topography and salmon diversity/productivity, have been extensively discussed (Ames 1994; Ames & Maschner 1999; Augerot 2005; Fitzhugh 2003; Hayden 1994, 1995; O'Leary 1996). The uniqueness of these conditions raises the question of whether the chain of causal relations from ARE to complexity observed there can be applied to fisher-foragers more generally.

Productivity of marine coastlines, estuaries and freshwater systems

Figure 15.2 depicts global marine productivity based on chlorophyll *a* concentrations – a proxy for phytoplankton abundance, and thus primary productivity (Behrenfeld & Falkowski 1997). Ocean productivity is greater at mid to high latitudes, with a notable increase at around 40° North and South. This latitudinal pattern is primarily a result of cooler water surface temperatures towards the poles, which allow for greater vertical mixing with nutrient-rich deep waters, in comparison to lower latitudes where the strong density differences between warm surface waters and cooler deep waters restrict mixing (Barnes & Hughes 1999; Jennings et al. 2001; Sigman & Hain 2012). Seasonal variation in productivity also varies with latitude. In the tropics, productivity fluctuates but is fairly constant throughout the year. At temperate climes there is a spring bloom in phytoplankton, which coincides with spawning among many fish species, as well as smaller autumn blooms, while summer productivity is lower due to low wind stress and higher solar radiation. In contrast, polar marine productivity peaks with light availability in the summer months (Barnes & Hughes 1999; Jennings et al. 2001; Sigman & Hain 2012).

Over this pattern sit additional areas of high ocean productivity, often from deep water upwelling. Coastal upwelling and enhanced productivity occur where wind moving along the coast drives surface waters away from the shores, and where obstacles deflect deep ocean current upwards. Coastal upwelling is primarily seen along the western coasts of continents (e.g., California, Peru, Chile, Northwest and Southwest Africa in Fig. 15.2), but coastal waters are typically of higher productivity than the open ocean regardless: in shallow coastal waters, rather than sinking into the depths, organic matter and light feed a productive ocean floor, which alongside additional nutrient run-off from the land feed rich ecosystems (Barnes & Hughes 1999; Jennings et al. 2001; Knauss & Garfield 2017). There is also much variation in coastal productivity (Perlman 1980). Estuaries are characterized by particular high productivity (Cloern et al. 2014; Day et al. 2012), as are gentle, rather than steep, and low relief coastal bathymetry and wide, shallow continental shelves. Notably, while these conditions occur at a range of latitudes across all continents, they are most widespread and consistently found along the previously glaciated wide coastal shelves of higher latitudes (Perlman 1980). Coupled with the broader oceanic productivity patterns, this reinforces the high productivity of higher latitude marine coastlines (Davis et al. 2014).

Patterns of freshwater productivity are complex, as they depend on multiple independent factors. The character and rate of primary productivity along a river's drainage network have been described as a gradient from a river's headwaters to its mouth, shaped by both biotic and abiotic factors that determine organic source matter, its potential storage and upwelling (Vannote et al. 1980). Furthermore, the downstream association with maximum terrestrial-aquatic fauna and upstream association with molluscs/crustacean fauna result in maximum micro- and macro-invertebrate species diversity in a river's midreach (Vannote et al. 1980). Mid-sized rivers, which have the widest range of temperatures and hydraulic conditions along the gradient, tend to have the highest biological diversity, while large rivers tend to have lower productivity overall – differences that are magnified by resource-spiralling (Johnson et al. 1995). Lakes and floodplains are associated with different aspects of this complex productivity gradient, shaped by their own biotic and abiotic features (Kimmel & Groeger 1984), as well as their point of intersection in the drainage (Bayley 1995; Sedell et al. 1989). River areas with the greatest interaction with floodplains are the most productive, and this productivity is strongly determined by the annual flood-pulses that shape them (Junk et al. 1989). At a spatial scale, freshwater fish communities are more diverse and more productive at lower latitudes, although the less diverse high latitude fish communities can be extremely productive (Rypel & David 2017).

The pronounced variation in the foraging carrying capacity offered across aquatic environments are critical for interpreting the range of ethnographic and prehistoric fisher-forager adaptations, and the levels of complexity they expressed.

Latitudinal bias in fisher-forager complexity

Although the distribution of ethnographically documented fisher-foragers may be biased, patterns in coastline productivity show that higher latitudes could best support intensive ARE and corollary aspects of complexity. In this section, we explore the extent to which complexity is restricted to high latitude fisher-foragers through Binford's (2001) dataset of 339 foraging populations (updated online version, Johnson 2006).

Binford's (2001) dataset includes an exceptional range of relevant ecological, economic, social and cultural variables, here coded in a manner appropriate for the following analyses (Table 15.1). Where referred to in-text, Binford's (2001) variable names are italicized and square-bracketed (e.g., total population size = [*tlpop*]). Concerning technological complexity, Binford (2001: 387–99) uses Oswalt's (1973, 1976) data on forager food-procurement technologies ('subsistants'). Oswalt (1973, 1976) defined the complexity of a subsistant based on its number of 'technounits' (individual components), and toolkit complexity as the average number of technounits per subsistant. While still relatively limited, many studies have since supplemented and analysed these data (see Read & Andersson 2020: 345–52, and references therein), so toolkit complexity data were gathered from the literature (primarily Osborn 1999; Shott 1986; Torrence 1983) and matched to populations in Binford's (2001) dataset following Collard et al. (2005).

The relationship between dependence upon aquatic resources and factors associated with aspects of complexity were assessed through regression analyses, with complexity as the dependent variables, using the entire non-equestrian forager sample.[4] Continuous dependent variables (total population size, mean aggregated group size, population density, number of residential moves per year, residential distance moved per year, niche breadth and technological complexity) were analysed through hierarchical multiple linear regression models in order to control for the effects of local ecological conditions and the statistical non-independence of cultural traits due to phylogenetic history (Galton's problem). To do so, effective temperature ([*et*]) and dummy variables for Binford's (2001) 'world sector' variable [*secno*][5] (see Table 15.1) were included as independent variables in the first block, followed by percentage aquatic resource-dependence (PARD: [*fishing*]) in the second (last) block. The effect of the last block on the model thus indicates the relationship between PARD and the respective dependent variable after controlling for ecological influences and Galton's problem. Relevant categorical variables (storage dependence, occupational specialization, ownership over resource locations, formal leadership, social class distinction, inter-group conflict) were recoded into dichotomous categories (Table 15.1) expressing the absence or presence of a trait, and analysed through

Table 15.1. *Variables from Binford's (2001) dataset that are discussed in-text and used in statistical analyses (indicated by *). For categorical variables, descriptions are provided for each coded value, and, where relevant, how they were recoded for binary logistic regressions. Note that categorical value descriptions are in places simplified from those provided by Binford (2001) and Johnson (2006).*

Variable	Coding variable	Variable description	Continuous/ categorical	Categorical value/description	Recoding for binomial logistical regression
Predominant food source	[*subsp*]	'indicates what food type supplies the majority of a group's nutritional intake' (Binford 2001: 117)	Categorical	1 = terrestrial animal 2 = terrestrial plant 3 = aquatic	
Percentage subsistence from aquatic resources*	[*fishing*]	'estimates (calculated as a percentage) of a group's dependence upon…aquatic organisms' (Binford 2001: 117)	Continuous		
World sector*	[*secno*]	Divides foragers primarily by continent with the exception of the large North American sample, which is further subdivided by region (see Binford 2001: Table 8.01)	Categorical	a = Asia b = South America (plus the Calusa of Florida) c = Sub-Saharan Africa d = Australia f = California and Northern Mexico g = North American desert and desert scrub (Great Basin and Mexico) h = North American steppic mounted hunters (Great Plains) i = North American Northwest Pacific coast j = North American subarctic and midlatitude forests k = North American Arctic	
Effective temperature*	[*et*]	'This measure simultaneously describes both the total amount and yearly distribution of solar radiation characteristic of a given place' and so 'is a measure of both the length…and the intensity of solar energy available during the growing season' (Binford 1980: 13; also see Binford 2001: 58–9)	Continuous		
Effective temperature (ordination)*	[*clim*]	A seven-point ordination of [*et*], ranging from coolest to warmest (Binford 2001: 70)	Categorical	1 = <10.00 (polar) 2 = 10–12.49 (boreal) 3 = 12.50–14.55 (cool temperate) 4 = 14.56–16.61 (warm temperate) 5 = 16.62–18.15 (subtropical) 6 = 18.16–22.57 (tropical) 7 = ≥22.58 (equatorial)	
Total population size*	[*tlpop*]	'total number of persons to whom the ethnographic description applied' (Binford 2001: 117)	Continuous		
Mean aggregated group size*	[*group2*]	'the mean size of the consumer group that regularly camps together during the most aggregated phase of the yearly economic cycle' (Binford 2001: 117)	Continuous		
Population density*	[*density*]	Total population size divided by 'ethnographers' estimates of the total land area occupied by the group in units of 100 square kilometres' (Binford 2001: 117)	Continuous		
Number of annual residential moves*	[*nomov*]	'average number of residential moves made by household units within the group on an annual basis' (Binford 2001: 117)	Continuous		

Table 15.1 *(cont.)*.

Variable	Coding variable	Variable description	Continuous/ categorical	Categorical value/description	Recoding for binomial logistical regression
Total residential distance moved annually*	[*dismov*]	'estimated total distance that these residential moves represent each year' in miles (Binford 2001: 117)	Continuous		
Niche breadth (subsistence diversity)*	[*subdiv2*]	'the standard deviation of the quantity of terrestrial plants, animals and aquatic resources estimated for each hunter-gatherer case' (Binford 2001: 403)	Continuous		
System state	[*systate3recod*]	An updated recoding (Johnson 2006) of Binford's (2001: 345) variable describing 'system state' [*systate3*], referring 'to formal properties of organization, which include leadership, internal differentiation of leadership status, associated roles relative to participation in decision making and the exercise of power with society'	Categorical	2 = 'horticulturally augmented cases' 3 = 'mutualists and forest product specialists' 4 = 'generic hunter-gatherers' 5 = 'generic hunter-gatherers with instituted leadership' 6 = 'wealth-differentiated hunter-gatherers' 7 = 'mounted hunters' 8 = 'stratified or characterized by elite and privileged leaders'	
Storage dependence*	[*store*]	'dependence upon storage' (Binford 2001: 388)	Categorical	1 = no storage beyond a day or two 2 = storage only for special events 3 = storage for seasonal/other low-productivity phases	Absent (0) = 1 Present (1) = 3 (values of '2' were excluded as ambiguous)
Occupational specialization*	[*occspe*]	'Occupational specialities reported which are not tied to the sexual division of labour or tendencies for role differences' (Johnson 2006; see Binford 2001: Table 9.01)	Categorical	1 = absent 2 = few (1–3) 3 = moderate (4–7) 4 = many (≥8)	Absent (0) = 1 Present (1) = 2–4
Ownership over resource locations*	[*owners*]	'ownership of resource locations' (Binford 2001: 426)	Categorical	1 = absent 2 = group claims exclusive rights over resource locations/residential sites/ home range 3 = group claims hunting areas/ dominant animals/fishing sites/ animal drive locations 4 = elite ownership of land and resources	Absent (0) = 1 Present (1) = 2–4
Formal leadership*	[*polyscal*]	An ordinal scale of political development (Binford 2001: 334; Johnson 2006)	Categorical	1 = 'performance based leadership' 2 = 'Senior males provide an advisory type of leadership' 3 = 'Formal or informal council of advisors with recognized leader' 4 = 'Instituted leader who presides over a council of near "peers"'	Absent (0) = 1 & 2 Present (1) = 3 & 4
Social class distinction*	[*class*]	'Type of social class distinction' (Johnson 2006; see Binford 2001: Table 9.01)	Categorical	1 = absent 2 = 'wealth distinctions only' 3 = 'dual stratification into a hereditary aristocracy and a class of ordinary people'	Absent (0) = 1 Present (1) = 2 & 3
Inter-group conflict*	[*gpgpcon*]	An ordinal scale of inter-group violence (Johnson 2006)	Categorical	1 = 'none reported' 2 = 'revenge raiding' 3 = 'accelerative raiding' 4 = 'accelerative conflicts of annihilation'	Absent (0) = 1 Present (1) = 2–4

hierarchical binary logistic regressions, again controlling for effective temperature and world sector using the first block, followed by the inclusion of PARD in the second (last) block. The relationship between the continuous variable for effective temperature ([*et*]) and the logit transformation of some binomial dependent variables was not linear (a necessary assumption of binary logistic regressions), so Binford's (2001) ordination of effective temperature ([*clim*]) was used instead – treated as a nominal variable as required by binary logistic regression models. For consistency, [*clim*] was used instead of [*et*] in all logistic models. For logistic regressions, world sector ([*secno*]) was also included as a nominal variable.

In order to assess the implications of a high latitude bias on the fisher-forager complexity paradigm, three regressions were carried out for each dependent variable: (1) including the entire sample in order to confirm whether the expected relationships between PARD and aspects of complexity hold true; (2) excluding populations at ≥40° latitude, North and South, to assess whether these relationships remain once productive high latitude coastlines are removed; (3) excluding populations at *less than* 40° latitude, North and South, to confirm that the relationships between ARE and aspects of complexity remain among the high latitude populations alone (Tables 15.2 and 15.3).

Analyses of the entire sample support *almost* all the expected relationships. Controlling for ecological influences and Galton's problem, greater PARD significantly predicts greater total populations size, aggregated group size and population density, reduced residential mobility (both number and distance of moves), and the presence of occupational specialization, ownership over resource locations, formalized leadership, class distinctions, and intergroup conflict. In all these cases (and all those below unless otherwise specified), the dependent variable was also significantly predicted by the whole regression model (including [*secno*] and [*et*]/[*clim*]). For niche breadth, however, while the whole regression model was significant, PARD alone showed no significant

Table 15.2. *Hierarchical linear regression models using percentage aquatic resource-dependence (PARD) to predict aspects of complexity, after controlling for effective temperature and world sector, using the total forager sample, a low latitude-only sample (<40°) and high latitude-only sample (≥40°). Significance: *<0.05, **<0.01; ***<0.001.*

		Whole model (IV: effective temperature, world sector, PARD)				Effect of PARD (last block) on model		PARD relationship with DV (controlling for effective temperature and world sector)	
DV	Populations in regression	N	*R*	*R*² (SE)	ANOVA	R^2_{change}	F_{change}	Partial correlation	Standardized β
Population size	All populations	310	0.485	0.235 (1.109)	9.191***	0.025	9.852**	0.179	0.235**
	<40° only	163	0.369	0.136 (1.198)	3.493**	0.004	0.649	0.065	0.071
	≥40° only	147	0.541	0.293 (0.987)	6.303***	0.043	8.234**	0.238	0.333**
Aggregated group size	All populations	269	0.619	0.384 (0.223)	16.050***	0.014	5.982*	0.151	0.190*
	<40° only	135	0.503	0.253 (0.201)	6.134***	0.009	1.446	0.106	0.111
	≥40° only	134	0.628	0.394 (0.239)	8.957***	0.041	8.417**	0.252	0.326**
Population density	All populations	311	0.787	0.619 (0.442)	48.656***	0.105	82.480***	0.464	0.481***
	<40° only	163	0.765	0.585 (0.403)	31.186***	0.190	71.104***	0.561	0.515***
	≥40° only	148	0.878	0.772 (0.383)	51.792***	0.082	49.830***	0.515	0.466***
Niche breadth	All populations	311	0.600	0.359 (8.627)	16.835***	0.000	0.114	0.020	0.023
	<40° only	163	0.501	0.251 (8.623)	7.412***	0.047	9.676**	0.242	0.255**
	≥40° only	148	0.825	0.681 (6.675)	32.707***	0.046	19.909***	-0.355	-0.348***
Number of annual residential moves	All populations	249	0.542	0.294 (0.562)	9.914***	0.076	25.779***	-0.313	-0.422***
	<40° only	129	0.517	0.267 (0.560)	6.293***	0.081	13.353***	-0.315	-0.344***
	≥40° only	120	0.630	0.397 (0.534)	8.052***	0.166	30.319***	-0.465	-0.636***
Total residential distance moved annually	All populations	224	0.690	0.476 (0.341)	19.370***	0.120	48.821***	-0.432	-0.524***
	<40° only	118	0.626	0.392 (0.347)	10.137***	0.154	27.789***	-0.449	-0.483***
	≥40° only	106	0.793	0.629 (0.313)	18.059***	0.146	37.819***	-0.532	-0.594***
Technological complexity	All populations	30	0.821	0.674 (1.071)	3.922**	0.000	0.003	-0.013	-0.017
	<40° only	14	0.739	0.546 (1.047)	1.033	0.094	1.241	-0.414	-0.709
	≥40° only	16	0.890	0.793 (1.189)	3.346	0.021	0.704	0.302	0.266

Table 15.3. *Hierarchical binary logistic regression models using percentage aquatic resource-dependence (PARD) to predict aspects of complexity, after controlling for effective temperature and world sector, using the total forager sample, a low latitude-only sample (<40°) and high latitude-only sample (≥40°). The regression predicting storage dependence using the high latitude-only sample could not be run as the model experienced separation (world sector perfectly predicted the likelihood of storage dependence in the basal model). Significance: *<0.05, **<0.01; ***<0.001.*

		Whole model (IV: effective temperature, world sector, PARD)				Effect of PARD (last block) on model		PARD relationship with DV (controlling for effective temperature and world sector	
DV	**Populations in regression**	**N**	**-2 Log likelihood**	**Nagelkerke** R^2	X^2	**Pseudo-** R^2_{change}	X^2_{change}	**Odds ratio**	**Wald** X^2
Storage dependence	All populations	309	61.849	0.921	350.056***	0.001	0.139	1.008	0.137
	<40° only	161	45.544	0.863	150.643***	0.000	0.001	0.999	0.001
	≥40° only	148	-	-	-	-	-	-	-
Occupational specialization	All populations	311	139.126	0.727	208.989***	0.052	20.397***	1.064	14.964***
	<40° only	163	45.600	0.678	67.656***	0.035	4.307*	1.040	3.774
	≥40° only	148	79.153	0.751	119.895***	0.065	15.251***	1.094	11.858**
Ownership over resource locations	All populations	311	245.786	0.598	185.091***	0.032	13.431***	1.013	12.286***
	<40° only	163	140.410	0.508	76.134***	0.025	4.588*	1.022	4.452*
	≥40° only	148	83.866	0.706	105.453***	0.020	4.221*	1.038	3.668
Formal leadership	All populations	311	256.634	0.450	117.564***	0.046	14.208***	1.035	13.244***
	<40° only	163	92.308	0.584	77.261***	0.020	3.361	1.026	3.274
	≥40° only	148	140.631	0.422	54.673***	0.093	13.886***	1.060	11.733**
Social class distinction	All populations	311	176.492	0.698	215.620***	0.034	14.661***	1.045	12.421***
	<40° only	163	58.053	0.613	63.307***	0.037	4.627*	1.043	4.108*
	≥40° only	148	106.426	0.645	97.419***	0.027	5.655*	1.041	4.902*
Inter-group conflict	All populations	305	138.016	0.711	195.351***	0.048	18.268***	1.071	11.927**
	<40° only	157	80.675	0.727	114.247***	0.061	13.473***	1.100	7.942**
	≥40° only	148	42.284	0.759	85.579 ***	0.009	1.409	1.034	1.099

relationship and did not significantly improve the model. The same was true for technological complexity and storage dependence.

One might have expected PARD to be associated with reduced niche breadth, implying a greater specialization towards aquatic, over terrestrially hunted or gathered, resources, but the results obtained suggest this is not the case. Regarding technological complexity, Oswalt (1973, 1976) and Osborn (1999) have argued for the importance of aquatic resource-dependence in determining forager toolkit complexity, but more recent analyses have identified environmental risk as the primary determinant (Collard et al. 2005, 2011, 2013; Read 2008; Read & Andersson 2020; Torrence 2001). Our results, showing no relationship between toolkit complexity and ARE, after controlling for effective temperature, are consistent with this. Indeed, the same might be said for storage dependence, which has been attributed primarily to seasonality and the unpredictability of resources rather than being associated with complexity (Morgan 2012).

The exclusion of high latitude populations from the regressions shows that, after controlling for effective temperature and world sector, greater PARD continued to significantly predict reduced residential mobility (number and distance of moves) and greater population density; however, it no longer predicted total population size or aggregated group size. Moreover, the exclusion of high latitude populations reveals a positive correlation between PARD and niche breadth, implying that at lower latitudes, increasing the amount of aquatic resources in the diet is associated with a more generalist strategy, incorporating them alongside terrestrial plant and animal resources rather than specializing towards aquatic resources. This contrasts with results from only higher latitude populations (≥40°), among whom, when added to the basal model, PARD not only significantly predicts greater population size, aggregated group size, population density, and reduced residential mobility, but also significantly *reduced* niche breadth (i.e., greater specialization towards aquatic resources). The non-significant relationship between ARE and niche breadth using the total sample would thus appear to result from opposing strategies above and below 40° latitude. We might expect these opposing latitudinal strategies to be reflected in similarly opposing correlations between technological complexity and PARD in the higher and lower latitude samples. While trends to this effect are observed, no significant relationships were found, although this may result from the small sample sizes (<40°, n = 14; ≥40°, n = 16).

Results concerning ownership over resource locations and inter-group conflict, on the other hand, might reflect these divergent low/high latitude strategies. Using only the <40° sample, the addition of PARD to the basal model significantly increased its power to predict ownership over resource locations, but the relationship is notably weaker than when both low and high latitude groups are included. This is consistent with more generalist strategies, whereby control of a specific resource may be of lesser importance than access to a wide range of them. However, perhaps unexpectedly, the significance of this relationship is weakened even further when only the high latitude sample is considered, to the extent of insignificance when applying the Wald test. Indeed, inter-group conflict is only significantly predicted by greater PARD among <40° groups, which, given that the typical benefits of warfare are control over/access to resources (e.g., territory, stored foods, slaves, females as brides), would be consistent with a weaker likelihood of ownership over resource locations at higher latitudes. Adding PARD to the basal model does not increase the likelihood of storage dependence among lower latitude societies, suggesting that stored foods are unlikely to be the cause of inter-group conflict. Unfortunately, this relationship could not be tested on the ≥40° sample, as the model experienced separation (world sector perfectly predicted the likelihood of storage dependence in the basal model).

Interpreting these results concerning the relationship between ARE and the likelihood of inter-group conflict – positive at lower latitudes, but insignificant at higher latitudes – is compounded by the multifaceted relations involved. Current perspectives on the association between warfare and complexity would predict opposite results: the higher latitude groups, dominated by non-egalitarian Northwest Coast fisher-forager populations that are often described as warring societies, should show a positive relationship between ARE and conflict, consistent with the view that the emergence of complexity was a turning point in the origins of warfare (Fry 2006), while at low latitudes, where complex foragers are less common, the relationship should be weaker. However, these expectations may be countered by two lines of argument: (1) conflict among Northwest Coast fisher-foragers may have been *internal* to their society, rather than *external*, as Ember (1975) argues is more common with high aquatic resource-dependence; and (2) their depiction as warring societies may be inaccurate as argued by Daly (2014), who stresses that accounts of Northwest Coast conflict date from a limited, exceptional, and thus unrepresentative, period of time (European contact), when long-term cultural mechanisms to avoid conflict (competitive feasting, gift-exchange or marriage alliances) failed. If the warring conditions recorded among Northwest Coast fisher-foragers were atypical, the associations between complexity and violence may be inaccurate, as observed by Allen et al. (2016). This, in turn, weakens the expectation that less complex groups, more common at low latitudes, should have reduced rates of conflict, and is instead consistent with more widespread conflict among foraging populations (Ember 1978; Keeley 1996). This decoupling of complexity and conflict is consistent with a deep chronology for inter-group violence (Allen & Jones 2014; Bowles 2009; Keeley 1996; Wrangham & Peterson 1996), as recently supported by early evidence among prehistoric tropical African fisher-foragers (Lahr et al. 2016).

Recent studies have emphasized population pressure and resource scarcity as determinants of inter-group conflict (Allen et al. 2016; Kelly 2013: 207–8; Nolan 2003). At lower latitudes where aquatic productivity is typically lower, ARE might be limited to localized areas of exceptional productivity over which there is intense competition, or involve high levels of resource competition overall, thus also accounting for the positive correlation between PARD and niche breadth at lower latitudes. Keeley (1996) has posited that when conditions enhance the risk of inter-group violence, societies develop mechanisms to overcome it. We would argue that this applies only when conditions are predictable, such as on the Northwest Coast, where the *risk* of ARE-related inter-group conflict could be large, seasonal and patterned, but consequently suppressed by cultural avoidance mechanisms, while at lower latitudes, risk of conflict is comparatively lower, but conditioned by unpredictable events, and so more commonly ensues.

Results concerning the relationships between PARD and markers of social inequality may lend further support to a decoupling of the latter with the incidence of inter-group conflict. In the <40° latitude sample, many of these relationships were weak: (a) when controlling for world sector and effective temperature, PARD only predicts the odds of formal leadership among higher latitude populations; (b) PARD was a weak predictor of occupational specialization in the <40° latitude sample and strongly significant in the high latitude-only sample; and (c) PARD shows a weaker, albeit significant, correlation with class distinction in the low latitude sample than in the high latitude-only one. These results certainly question a relationship between ARE and social inequality at lower latitudes, where it would appear to be much diminished.

The range of potential explanatory mechanisms for the emergence of social inequality (or lack thereof) is vast – each positing different aspects of complexity as causes, conditions, or consequences of the others (Arnold 1996; Price & Brown 1985). We might expect, however, that any differences in the relationship between ARE and social inequality between high and low latitude groups relate to those other aspects in which they most clearly differ with regards to PARD: niche breadth and aggregated group/population size. For example, in comparison to the <40° latitude generalist strategy, the ≥40° latitude specialization on aquatic resources might be expected to promote inequality through mechanisms such as the efficient coordination of labour and the emergence of leaders to control it (Ames 1981, 1985, 1994). This could also be enhanced by larger group/population sizes that detriment efficient decision-making and social cohesion (Hamilton et al. 2007; Johnson 1982), and require greater food quantities, thus driving specialization and complexity through enhanced population pressure (Cohen 1977; Keeley 1988). Alternatively, we might expect population growth to be *driven* by abundant aquatic resources, and social inequality to emerge with control over surplus (Hayden 1994, 1995, 2001). Either way, it is reasonable to infer that indications of a weaker relationship between aquatic resource-dependence and social inequality at lower latitudes might be attributable to a more generalist subsistence strategy, lack of consistently larger group/population sizes, unequal ecological distribution of productive areas and/or ecological unpredictability (monsoons, droughts, lack of seasonality, etc.).

The above findings challenge a universal association of a fisher-forager subsistence with complexity. The following section takes this further by exploring the paradigm of fisher-forager complexity, not just in an ethnographically unrepresented region, but a period in time marked by distinct climatic patterns to the present day: the African Aqualithic.

Prehistoric fisher-foragers and the African record

Archaeologically documented foragers help to fill gaps in the ethnographic record. Several complex prehistoric fisher-forager societies are known from areas that are ethnographically less well-documented – e.g., the late Mesolithic Ertebølle culture of Scandinavia (Layton & Rowley-Conwy 2013; Price & Brown 1981), the Jōmon of Japan (Pearson 2008; Takeshi 2014), or the preceramic cultures of the Peruvian (Moseley 1975, 1992; Osborne 1977; Richardson 1981), southern Brazilian (DeBlasis et al. 1998; Fish & Fish 2010) and Paraná-Plata (Loponte et al. 2006) coasts. Unsurprisingly, these complex fisher-forager societies tend to be found along the most highly productive coastlines, particularly at more productive higher latitudes (Bailey & Milner 2002). Whether foragers are pushed or pulled into ARE, they are more likely to do so where waters are most productive. Indeed, these more productive aquatic environments are more likely to be able to support large, sedentary and population dense societies (Perlman 1980). There are, of course, exceptions. The Yamana (Yahgan) of Tierra del Fuego – the highest latitude Southern Hemisphere fisher-foragers – practiced a nomadic lifestyle with relatively small group sizes, no permanent structures, little or no storage, and no formalized social inequality (Lothrop 1928; Yesner 1987; Zangrando 2009). In fact, the Yamana intensified resource exploitation in the past 1000 years, but through diversification as opposed to the specialization seen on the Northwest Coast; a difference argued to be the key to their lack of complexity (Zangrando 2009).

Putting exceptions aside, complex fisher-foragers, both ethnographic and archaeological, are *most commonly* found along the most productive, often higher latitude, coastlines (Bailey & Milner 2002). The preceding discussions concerning trends in aquatic productivity show there is reasoned logic behind this pattern, but it is clear from Figure 15.2 that it does not account for low latitude fisher-foragers, many of whom are egalitarian. Equally apparent is the glaring absence of African fisher-foragers, most of whom exploited freshwater resources, and who are only rarely considered in discussions concerning forager ARE or complexity (Plug 2006).

As the birthplace of not only our species, but the earliest intensive ARE, Africa is paramount to our understanding of fisher-forager adaptations. Archaeological evidence for the earliest systematic ARE is associated with Middle Stone Age (MSA) assemblages along the South African coast, focused on intensive mollusc and some marine mammal exploitation (Jacobs 2010; Marean 2014; Marean et al. 2007) but with no clear evidence of technological specializations towards ARE, as might be expected were these populations primarily dependent on aquatic resources. However, Africa is also home to one of the earliest ARE-associated technological specializations: the barbed bone harpoon.

Dates for the earliest African bone harpoons are roughly contemporaneous with the South African coastal adaptation (Brooks et al. 1995; Feathers & Migliorini 2001; Yellen et al. 1995; but see Klein 2008, 2009: 527), but their isolated occurrence at this time limits the inferences that may be drawn. Similar artefacts from

Ishango are dated to ≤25 ka (Crevecoeur et al. 2016), but the majority date to the African Humid Period (AHP, 11.5–5 ka; deMenocal & Tierney 2012; Yellen 1998). The AHP is a period of greatly increased precipitation associated with precessional changes in the Earths' axis that, in turn, influenced the North African summer monsoon, leading to the dramatic expansion of inland lakes and rivers across East Africa, the Sahel and a vegetated Green Sahara (deMenocal & Tierney 2012; Gasse 2000; Kuper & Kröpelin 2006; deMenocal & Tierney 2012; Tierney & deMenocal 2013). During this time, a major economic and cultural expansion of fisher-foragers using bone harpoons extended from East Africa to the Atlantic Coast – a cultural phenomenon that Sutton (1974, 1977) coined the 'African Aqualithic' (herein 'Aqualithic').

The Aqualithic represents one of the most geographically widespread and longest-lived specialized fisher-forager adaptations. Yet, its relationships with complexity have not been explored. There are multiple differences in the distribution of resources between freshwater inland littoral environments and marine coastlines. While the midreach of the Niger River, the Nubian Nile, deltas, the floodplains of large lakes such as Chad and Turkana, and marshes such as the Sudd might have offered extremely rich habitats, much of the remaining fast-flowing portions of rivers, small streams and topographically bounded lakes and shallow Saharan water bodies would have had lower carrying capacities, even if waterfowl dispersal of invertebrates such as *Artemia* sp. (Green et al. 2005; Sánchez et al. 2007) created localized conditions for specialized ARE, as seen with the traditional Dawwādah population in Fezzan (Thomas 1968). Therefore, whether abundant and predictable resources enabled specialized ARE with economic and sociocultural adaptations paralleling the Northwest Coast, or aquatic intensification through diversification saw low complexity fisher-foragers more similar to the Yamana, or conditions drove an entirely unique Aqualithic fisher-forager adaptation, remains unknown.

Fisher-forager complexity in the African Aqualithic

O'Neill (2014) highlights three underlying causal factors that enabled the emergence of complexity along the Northwest Coast to which we might attempt to draw parallels with the Aqualithic: 1) 'superabundance' of a virtually inexhaustible, predictable resource (on the Northwest Coast, salmon since *c.* 5 ka), 2) availability of a new raw material (increased red cedar stands after 4 ka) and associated technological innovations (wood-working), which allowed for the storage of surplus, construction of large permanent storage facilities, dwellings, monumental social structures, and sea-faring canoes, and 3) novel bone technology, providing a malleable resource for specialized fishing gear (from *c.* 1.5 ka). The Aqualithic is associated with barbed points, an innovation in bone (and sometimes horn, ivory or even wood) that seems to have facilitated this specialized ARE-based economy. Novel raw material availability, comparable to Northwest Coast red cedar stands, could have also played an important role in the Aqualithic adaptation. Palynological studies show that the Sahara was colonized by a diverse vegetation with no modern analogue during the AHP, ranging from moist tropical woodland to xeric-adapted grasses, and particularly gallery forests along freshwater rivers and lakes (Hély et al. 2014; Watrin et al., 2009; Hély et al. 2014), which could have provided comparable materials for wood-working. Indeed, in exceptional cases, the use of wood in construction is attested at Aqualithic sites (Davies 1966; Hassan 1988; Phillipson 1982), and polished stone axes and adzes, considered to be associated with wood-working activities (Binneman & Deacon 1986; Clark 1958; Gould 1971), are also frequent.

Besides structures, wood may have been used in constructing rafts or dug-out canoes, as seen among contemporary African subsistence fishermen (Scherrer 1978; Sobania 1980), and attested by the exceptionally well-preserved dug-out canoe from Dufuna, near the palaeoshores of 'Lake Mega-Chad' in Nigeria and dated to 7670 ± 110 BP (Breuning et al. 1996). Equally, wood-working may have been important for making bone harpoons themselves (Mbow 1998; Ravisé 1970). It is also possible that wood was worked into storage containers comparable to the Northwest Coast (O'Neill 2014), but supportive evidence is lacking. Direct evidence of Aqualithic storage is limited to the granaries found at Fayum (Caton-Thompson & Gardner 1934) and Merimda Beni Salam (Hassan 1988), and potentially conical pits filled with *Pila* shells from Shabona, Sudan (Clark 1989). We might, instead, posit that pottery, which is commonly found at Aqualithic sites, offered a comparable innovation in storage technology, as inferred from large vessels at sites like Kobadi (Jousse et al. 2008) and the Atbara region of the Middle Nile (Haaland 1995).

Assessing any resource 'superabundance' comparable to Northwest Coast salmon at Aqualithic sites is difficult as many lack well-documented faunal assemblages. However, where reported, certain species *are* recurrently, although not universally, found across a range of sites – catfish (especially *Clarias* and *Synodontis* spp.), Nile perch (*Lates niloticus*), cichlids (often *Tilapia* spp.), hippopotamus, crocodile and a range of freshwater molluscs. At some sites, one or more of these species clearly dominates the faunal assemblage, possibly reflecting their abundance (e.g. Petit-Maire 1983; Robbins et al. 1994; Sereno et al. 2008; Stewart 1989; Wendt 1996; Yellen et al. 1995). However, despite noted associations between particular species and the geography of Aqualithic sites during the AHP that may indicate economic specializations (Drake et al. 2011), none of the recorded taxa are universal to *all* Aqualithic sites to the extent that we might propose a superabundance and comparable specialization to Northwest Coast salmon exploitation. Indeed, some sites show a mix of both floodplain and open-water species (Haaland 1995), suggesting serial seasonal specializations rather than intensive seasonal investment, while at others the similarities in species-specific prevalence in both cultural and non-cultural layers suggest no preference or specialization in fishing activities (Phillipson 1977). Therefore, although the AHP is clearly associated with a proliferation of aquatic resources in general, it seems unlikely that it reflects a widespread adaptation to the superabundance of particular taxa.

Although it is clear that the Aqualithic does not parallel the specialized fisher-forager adaptations of the Northwest Coast, the evidence suggests that the AHP may have sustained comparable conditions under which complexity could emerge. To address this, a database of AHP sites with barbed bone harpoons was constructed from data in the literature and from recent excavations in Turkana (unpublished, IN-AFRICA project) with the intent of identifying indicators of complexity (see Ames 2008; Hayden 2001, 2014). Ten potential indicators of complexity were recorded for each site – middens, pottery, grinding tools, settlement permanence, domesticates, ornaments, other prestige objects (excluding elaborate pottery and ornaments), grave goods, inequality in burials, and specialized funerary monuments or locations (see Table 15.4), as well as the site's location, type of archaeological investigation, dating (where available), primary water-source at the time of occupation, potential taxon-dominance in the faunal assemblage, and the number of harpoons found (where available). All identified sites are plotted in Figure 15.3.

Sites were attributed to one of four broad 'periods' separated by major climatological events on the basis of available radiometric dates or presence of domesticates: >11.8 ka (preceding the end of the Younger Dryas cold phase); 11.8–8.2 ka (between the Younger Dryas and 8.2 event), 8.2–5.5 ka (between the 8.2 event and the end of the AHP), and <5.5 ka (post-AHP). Sites were also divided into seven regions (East Africa, Nile Valley,

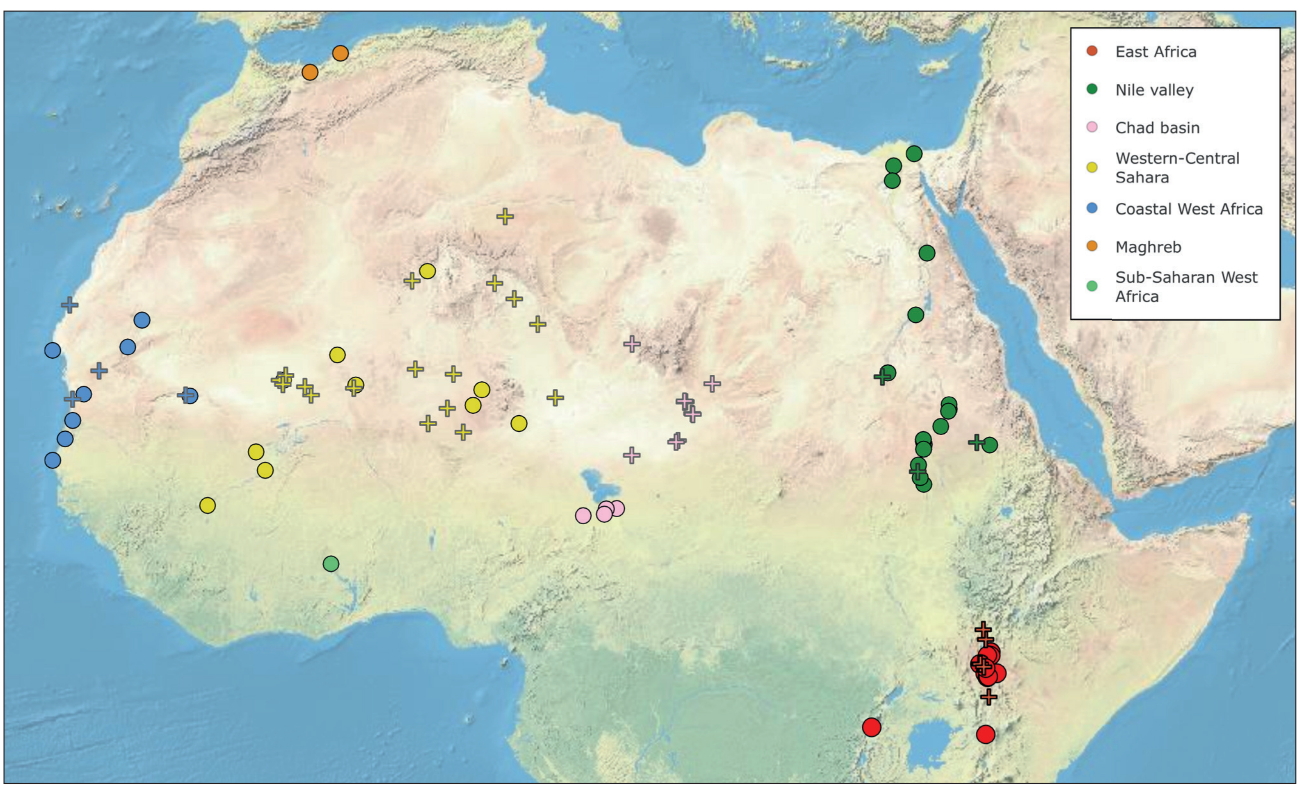

Figure 15.3. *Harpoon-bearing sites of northern Africa, divided by region. Circles mark excavated sites and crosses mark unexcavated sites.*

Table 15.4. *Indications of complexity identified at Aqualithic sites that are used in the analyses, and their association with complexity.*

Indicator of complexity	Association with complexity
Middens	Suggest prolonged occupation of site and reduced mobility
Pottery	Practical constraints of transporting reduces mobility (Haaland 1995), possibly used for storage, implying reduced mobility (Keeley 1988; Morgan 2012; Soffer 1989), and where elaborate/decorated, can be considered a prestige object (Hayden 1998; see below)
Grindstones	Practical constraints of transporting reduces mobility (Haaland 1995), and if used to grind pigment, associated with personal ornamentation, art, decorating prestige objects or ritual
Settlement permanence (e.g., permanent structures or exceptional evidence of prolonged settlement)	Reduced mobility
Domestic fauna and/or plants	Indicates ownership and control over resources, and possibly territories to support them, and associated with enhanced inequalities compared to foraging economies (Kohler et al. 2017; Smith et al. 2010 and references therein; cf. Gurven et al. 2010)
Ornaments	Implies potential for, and a marker of, inequality in material wealth and social status (Hayden 1998; Plourde 2009; Smith et al. 2010), and also associated with enhanced population size/density and relating differential social and group identities (Kuhn & Stiner 2007)
Prestige goods (beyond elaborate pottery and ornaments, e.g., decorated bone or shell, figurines, cosmetic pallets)	Implies potential for, and a marker of, inequality in wealth and social status (Hayden 1998; Plourde 2009; Smith et al. 2010), as well as potential links to the more developed ritual/religiosity associated with greater complexity (Peoples & Marlowe 2012; Peoples et al. 2016)
Grave goods	Potentially indicative of ownership, material wealth and/or social status (e.g., Fochesato & Bowles 2017; Hayden 1998; Smith et al. 2010), of economic surplus, where subsistence-related (e.g., Fuller & Grandjean 2001), and of developed ritual/religiosity associated with greater complexity (Peoples & Marlowe 2012; Peoples et al. 2016)
Inequality in burials	Indicative of social inequalities in wealth and/or status
Specialized funerary monuments/ locations (e.g., cemeteries, necropolises, burial mounds and structures)	Indicates a degree of sedentism (ties to area), suggests group ownership over location, and suggests developed ritual/religiosity associated with greater complexity (Peoples & Marlowe 2012; Peoples et al. 2016)

Chad basin, western-Central Sahara [Niger, Mali, southern Algeria], coastal West Africa, Maghreb, and sub-Saharan West African [forest/forest edge]). The presence of each indicator of complexity was given a score of '1', and their sum was used as an overall crude 'complexity score' for each site. Important aspects of these sites are not captured in either the database or the complexity score – details for each site vary hugely, ranging from dedicated tomes (e.g., the Khartoum Hospital site [Arkell 1949]), to brief footnotes (e.g., Edjeleh [Hugot 1963: 127 fn 11]), while different site functions mean they are not directly comparable (for example, Catfish Cave is described as a seasonally accessible fishing location [Wendt 1966], Minshat Abou Omar a cemetery site [Debowska-Ludwin 2014], and remains of wattle-and-daub structures at Ntereso suggest a semi-permanent settlement [Davies 1966]). Nevertheless, although the derived complexity scores are inappropriate for a site-by-site comparison, by excluding non-excavated sites with potentially unrepresentative complexity scores from the statistical analyses (unless stated otherwise), the data provide useful insights into broader trends and patterns in the Aqualithic record.

The average complexity score of 3.21 (n=71, SD = 2.35) is relatively low. Pottery was by far the most common indicator of complexity (n= 55), followed by grindstones (n=35) and personal ornaments (n= 31), while the remaining indicators were found in no more than one-third of cases, with evidence of settlement permanence being the least common (n = 9). Several sites lacked any indicators of complexity (Catfish Cave [Wendt 1966], FxJj12 [Barthelme 1985], the middle levels of the Koobi Fora Spit [Nelson 1991], lower levels at Lowasera [Phillipson 1977], Kokito 01 and 02 [Beyin 2011], and Tagra [Adamson et al. 1974), and no sites have the maximum complexity score of 10. However, this might, in some cases, be attributed to the chosen indicators. A cemetery site, for example, might not be expected to have evidence of middens, while the absence of burials at settlement sites does not mean they did not exist elsewhere, and discounts the possibility of finding several indicators (grave goods, burial inequalities, specialized funerary monuments or locations). Indeed, the top scoring sites (Kadero 1 with '9' [Chlodnicki et al. 2011], Dia-Shoma with '8' [Bedaux et al. 2005], Daima with '8' [Connah 1976, 1981]) are all settlement sites *with* burials, although they still fall short of the maximum complexity score.

Table 15.5 summarizes the total number of harpoons, the total number of sites from which these originate, and the mean number of harpoons per site by region and date period, as proxies for the relative importance of ARE to subsistence economies in late Pleistocene/Holocene tropical Africa. Climatic proxies indicate that the AHP reached its height around 9 ka (Claussen et al. 2017; deMenocal & Tierney 2012), and we might expect the importance of ARE to follow this same trend. Using the total sample (excavated and non-excavated sites), both the number of harpoon-bearing sites and total number of harpoons peak at 11.8–8.2 ka, although a few sites with anomalously high numbers of harpoons (such as the lower levels of Ishango 11, where >300 harpoons were found [Brooks & Smith 1987; de Heinzelin de Braucourt 1957]) skew the mean values. If the lower Ishango 11 levels are excluded, mean number of harpoons/site would also follow the expected pattern. Similar patterns can be seen at regional scales where records transcend several periods. The Nile Valley peaks in all three variables at 11.8–8.2 ka, as does East Africa in total number of sites and harpoons, but at 8.2–5.5 ka for mean number of harpoons (excepting the effect of Ishango 11), although the western-Central Sahara and Atlantic coastal region show a more complex pattern depending on which variable is considered.

Number of harpoons shows no association with complexity score, as might be expected were complexity associated with aquatic resource-dependence. Complexity itself does shows a small but significant chronological trend of increasing complexity over time, whether the Ishango temporal outliers with low

Table 15.5. *Proxies for the importance of aquatic resources at Aqualithic sites by region and date period: total number of harpoons (Σ), number of sites from which they come (n), and mean number of harpoons per site ($\bar{x}$). The data originate from both excavated and non-excavated sites.*

	>11.8 ka				11.8–8.2 ka				8.2–5.5 ka				<5.5 ka				All			
	n	Σ	$\bar{x}$	SD	n	Σ	$\bar{x}$	SD	n	Σ	$\bar{x}$	SD	n	Σ	$\bar{x}$	SD	n	Σ	$\bar{x}$	SD
East Africa	3	427	142.33	131.69	21	625	29.76	58.07	3	507	169.00	142.53	3	79	26.33	36.09	30	**1638**	**54.60**	87.71
Nile Valley	1	8	8.00	-	9	288	32.00	89.26	6	89	14.83	19.16	-	-	-	-	16	**385**	**24.06**	66.79
Chad basin	-	-	-	-	-	-	-	-	4	5	14.83	19.16	7	55	7.86	13.50	11	**60**	**5.55**	10.98
Western-Central Sahara	-	-	-	-	2	217	108.50	129.40	13	54	4.15	8.66	9	76	8.44	10.88	24	**347**	**14.46**	40.64
Coastal West Africa	-	-	-	-	1	1	1.00	-	4	17	4.25	1.50	2	6	3	2.83	7	**24**	**3.43**	1.99
Maghreb	1.00	1	1	-	-	-	-	-	1	1	1.00	-	-	-	-	-	2	**2**	**1.00**	0.00
Sub-Saharan West Africa	-	-	-	-	-	-	-	-	-	-	-	-	1	5	5.00	-	1	**5**	**5.00**	-
All	5	**436**	**87.20**	119.90	33	**1131**	**34.27**	70.83	31	**673**	**21.71**	62.20	22	**221**	**10.05**	16.38	91	**2461**	**27.04**	63.84

Table 15.6. *Mean complexity scores ($\bar{x}$) for Aqualithic sites by region and date period. Complexity scores were only calculated for excavated sites.*

	>11.8 ka			11.8–8.2 ka			8.2–5.5 ka			<5.5 ka			All		
	n	$\bar{x}$	SD	n	$\bar{x}$	SD	n	$\bar{x}$	SD	n	$\bar{x}$	SD	n	$\bar{x}$	SD
East Africa	3	1.00	1.00	16	1.19	1.05	2	3.50	2.12	4	2.50	1.29	25	**1.56**	1.33
Nile Valley	-	-	-	8	3.13	2.53	11	4.73	2.57	-	-	-	19	**4.05**	2.61
Chad basin	-	-	-	-	-	-	-	-	-	4	6.00	1.83	4	**6.00**	1.83
Western-Central Sahara	-	-	-	2	3.50	0.71	6	4.33	2.42	4	5.00	2.58	12	**4.42**	2.19
Coastal West Africa	-	-	-	1	3.00	-	5	3.00	1.41	2	3.00	1.41	8	**3.00**	1.20
Maghreb	1	1.00	-	-	-	-	1	3.00	-	-	-	-	2	**2.00**	1.41
Sub-Saharan West Africa	-	-	-	-	-	-	-	-	-	1	7.00	-	1	**7.00**	-
All	4	**1.00**	0.816	27	**2.00**	1.84	25	**4.12**	2.24	15	**4.47**	2.30	71	**3.21**	2.35

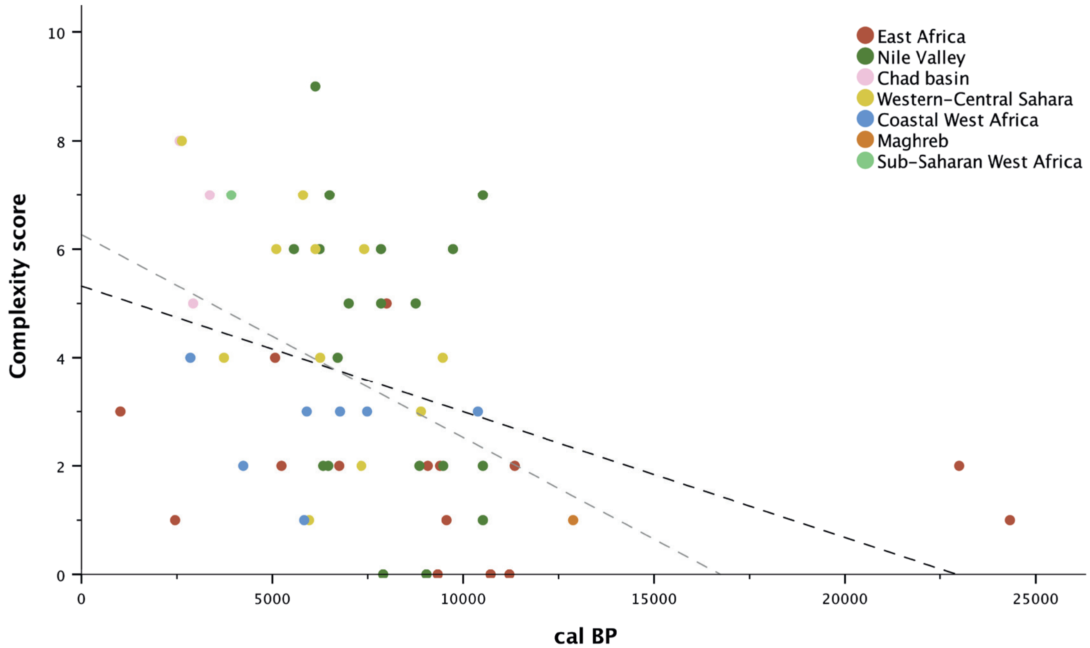

Figure 15.4. *Plot of complexity scores for Aqualithic sites over time (measured as cal.* BP *dates – midpoint of range, using only those sites for which radiocarbon dates were available), with the best-fitting regression curves when including (black) and excluding (grey) the lower levels at Ishango 11 (far right temporal outliers).*

complexity scores (24,994–23,660 cal. BP) are included (best fitted linear regression; n = 57, r^2 = 0.152, F = 9.867, p = 0.003) or not (best fitted linear regression; n = 55, r^2 = 0.171, F = 10.960, p = 0.002; Fig. 15.4). Mean complexity scores by 'date period' in Table 15.6 (based on a broader dataset that includes undated sites) show the same pattern, and this relationship is also best fitted with a linear regression when treating 'date period' as an ordinal independent variable against complexity score, is again best fitted with a linear regression (n = 71, r^2 = 0.236, F = 21.309, p = <0.001).

The fewer number of sites after 5.5 ka (Tables 15.5 and 15.6) might indicate that Aqualithic populations persisted where supported by productive refugia, such as the Chad basin, sub-Saharan West Africa and East Africa, which continue to support subsistence fishermen to this day, but the increase in complexity over time does not necessarily reflect ARE intensification/specialization. Domestic cattle are present in the Sudanese Nile Valley from *c.* 8 ka, spreading westwards through the Sahara after 7 ka, reaching the Central Sahara by *c.* 6 ka and West Africa by *c.* 4 ka (Dunne et al. 2012; Garcea 2016; Gifford-Gonzalez & Hanotte 2011; Kuper & Kröpellin 2006; Linseele et al. 2014; Marshall & Weissbrod 2011). The faunal and archaeological evidence from North African sites also shows that domesticates were added to a fisher-forager economy (Gatto 2011; Kuper & Riemer 2013). The relative importance of ARE in this new mixed economy is, however, unclear. While the large number of harpoons at some of these domesticate-bearing sites suggests that ARE was still an important economic activity (e.g., Shaheinab [Arkell 1953], Daima [Connah 1976, 1981), most sites have less than 10 harpoons, and some only single fragments (e.g., Aguendemen [Gaussen & Gaussen 1988], Arlit [Bernus & Lhote 1989]), suggesting that ARE played a minor role. Thus, it is likely that the greater complexity in more recent North African harpoon-bearing sites is associated with a transition towards food-producing economies (Kohler et al. 2017; Smith et al. 2010; cf. Gurven et al. 2010). Indeed, many of the higher complexity scores are found at domesticate-bearing sites (n = 16, $\bar{x}$ = 5.44, SD = 2.19) and especially those where domesticate-dominated faunal assemblages are reported (n = 5, $\bar{x}$ =7.20, SD = 1.92). Sites with fish-dominated faunal assemblages, on the other hand, show similar low levels of complexity (n = 40, $\bar{x}$ =2.80, SD = 2.00) to the few wild mammal-dominated sites (n = 5, $\bar{x}$ =3.00, SD = 2.77), suggesting that relative ARE-dependence has little effect on complexity. This is further supported by the fact that sites in East Africa, the only region to be represented across all time periods, often with the highest number of sites and harpoons (Table 15.6) and where domesticates are introduced after the end of the AHP (Hildebrand & Grillo 2012; Wilshaw et al. 2016), have consistently low complexity scores (Table 15.6).

Broad estimates suggest that the AHP was characterized by a northerly shift of vegetative biomes, with the tropical rainbelt – the zone of maximum precipitation – peaking between 15–20° N, with drier and more seasonal environments below, and desertic environments dramatically reduced and limited to regions above 25–30° N (Hély et al. 2014; Larrasoaña et al. 2013; Watrin et al. 2009; Wright 2017). Less productive aquatic environments in these drier conditions might explain the low complexity scores of East Africa, as well as the Maghreb (Table 15.6). Indeed, the relationship between latitude and complexity score is best fitted with a quadratic regression (n = 71, r^2 = 0.241, F = 10.805, p = <0.001; Fig. 15.5), peaking at around 20° N with a complexity score between 4 and 5, and gradually decreasing below 15° and above 25° N, primarily as a result of low East African and Maghrebian scores, respectively. Excluding post-AHP sites (<5.5 ka) produces similar results, with a slight northerly shift (n = 56, r^2 = 0.271, F = 9.860, p = <0.001; Fig. 15.5). In both cases, however, there is much regional variation between 10 and 25° N: coastal West African sites exhibit consistently low complexity scores, western-Central Sahara and Nile Valley sites vary widely, and post-AHP Chad basin and sub-Saharan West African sites score highly (all ≥4).

On a broad scale, regional variation is reflected in a relationship between longitude and complexity score that is best fitted with a cubic regression, whether post-AHP sites are included (n = 71, r^2 = 0.224, F = 6.452, p = 0.001) or excluded (n = 56, r^2 = 0.213, F = 4.702, p = 0.006; Fig. 15.6), driven primarily by lower complexity scores to the east, where most harpoon sites lack domesticates, and to the west. Nevertheless, the inflection of the regression curve towards higher complexity in the Atlantic coastal region might reflect the localized marine upwelling in this area (Fig. 15.2), although many of these sites are inland with fresh water-sources, and those that are on the Atlantic coast range in complexity from 1 (Kayar [Thiam 2012]) to 5 (Cansado [Vernet 2016]). The potential effect of the northward migration of the intertropical convergence zone on coastal productivity during the AHP is also unknown (Chavez 2012; Junginger et al. 2014; Wright 2017). Moreover, comparing complexity scores by crude water-source distinctions (lake, river or ocean) shows that river sites have the greatest mean score, but also the greatest variance (lake: n = 41, $\bar{x}$ = 2.80, SD = 2.17; river: n = 26, $\bar{x}$ = 3.85, SD = 2.63; ocean: n = 4, $\bar{x}$ = 3.25, SD = 1.71), perhaps reflecting relative positioning along the rivers drainage network.

Returning to our opening questions to this section: can we understand Aqualithic fisher-forager adaptations, and in particular Aqualithic complexity, based on models derived from recent, predominantly high latitude and maritime-dependent fisher-foragers? It is, first of all, clear that while the climate, available raw materials and technological innovations of the AHP may have provided conditions under which fisher-forager

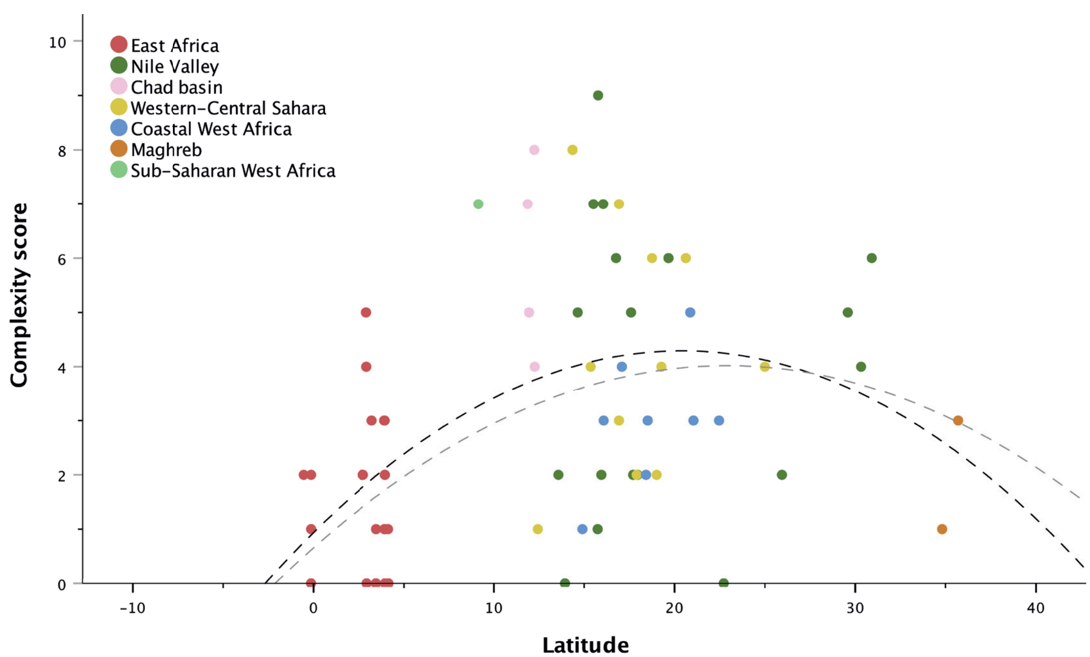

Figure 15.5. *Plot of complexity scores for Aqualithic sites by latitude, with the best-fitting regression curves when including (black) and excluding (grey) post-AHP (<5.5 ka) sites.*

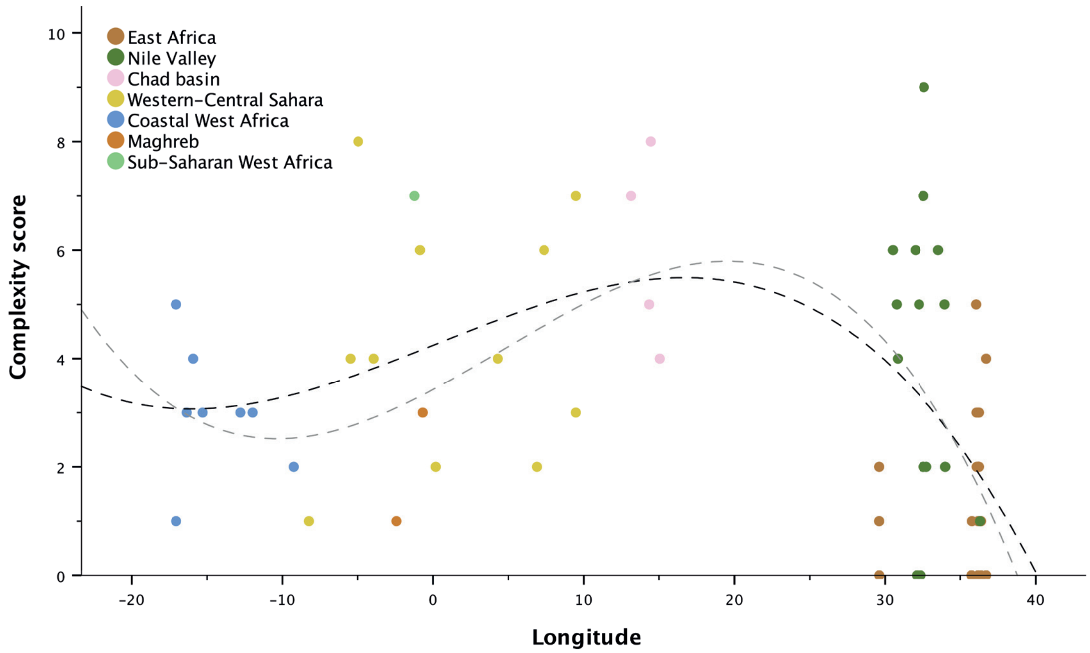

Figure 15.6. *Plot of complexity scores for Aqualithic sites by longitude, with the best-fitting regression curves when including (black) and excluding (grey) post-AHP (<5.5 ka) sites.*

complexity could emerge, the outcome is not comparable to the Northwest Coast. An argument could be made that, like the Yamana, most African AHP fisher-foragers diversified their economic base through time, but by the addition of domesticates rather than additional aquatic species, and that this development is associated with the trend towards increased complexity. Most important, however, is the variation in the adaptations shown in these harpoon-bearing sites across both large and small temporal and geographic scales. Altogether, the data suggest that multiple ecological, historical and demographic constraints among AHP tropical African fisher-foragers created a different set of relationships between dependence on aquatic resources and the various attributes of complexity from what is observed among high latitude ethnographic populations.

Fisher-forager complexity, past and present

First and foremost, the preceding sections show that fisher-foragers are too often portrayed as representing a homogenous adaptation, and one that is characterized by those traits typical of Northwest Coast populations. Consequently, there has been a long-standing association between intensive ARE and complexity (Roscoe 2006; Yesner 1980, 1987). We argue that support for this viewpoint has come from ethnographic and archaeologically documented fisher-foragers occupying exceptionally productive, and typically high latitude marine coastlines, which are unrepresentative of the fuller spectrum of fisher-forager adaptations. Our results show that, when considered separately, low (<40°) and high (≥40°) latitude ethnographic foragers show a series of interesting differences with respect to aquatic resource-dependence: (1) in contrast to high latitude groups, aquatic resource-dependence among lower latitude foragers shows no relationship with aggregated group/populations sizes; (2) intensification upon aquatic resources is associated with increased niche breadth at lower latitudes, but aquatic resource-specialization at higher latitudes; (3) increased aquatic resource-dependence predicts a greater likelihood of inter-group conflict only in the low latitude sample; (4) aquatic resource-dependence is positively correlated with the likelihood of social inequalities among higher latitude foragers, but these relationships are much weaker, and in some cases absent, in the low latitude sample.

These differences might be best explained by the lower productivity of lower latitude aquatic environments, which are unable to support large group sizes, require a more generalist strategy, and impose comparatively higher resource stress leading to increase competition and rates of conflict. It may be that the more productive, as well as geographically and temporally predictable aquatic environments of higher latitudes, which support larger, more-specialized fisher-forager populations, impose a greater *risk* of inter-group conflict, but that this is consequently suppressed by cultural avoidance mechanisms (Daly 2014; Keeley 1996). Either way, it would appear that the lower latitude adaptations to ARE impinge on the complex web of causes, conditions and consequences that produce social inequalities (Arnold 1996; Price & Brown 1985).

These observations among ethnographic groups are corroborated by an analysis of prehistoric tropical fisher-foragers of late Pleistocene/early Holocene Africa, who represent one of the most geographically widespread and longest-lived fisher-forager traditions. By occupying low latitude, and primarily inland freshwater habitats, the African Aqualithic presents a unique juxtaposition to groups of the Northwest Coast. These prehistoric fisher-foragers were shown to exhibit some, but not all of the economic, demographic, and sociocultural attributes of complexity, as well as geographic and temporal variation in these traits, suggesting a diversity of fisher-forager adaptations. Much like ethnographic populations, their dependence on aquatic resources (proxied by the number of harpoons and harpoon-bearing sites by which they are represented) also appears to reflect aquatic productivity throughout the AHP. However, while broad geographic variation in the degree of complexity represented at sites reflects ecological conditions, greater complexity appears primarily associated with economic diversification into a broader niche over time, characterized by the incorporation of domesticates into a fisher-forager economy.

Both the ethnographic and African archaeological case studies presented strongly suggest that fisher-forager economies and complexity are neither inherently nor universally associated, and that adaptations to ARE, past and present, are characterized by diversity.

Notes

1. The term 'forager' or 'foraging population' is used here in favour over 'hunter-gatherer' due to the latter's economic implications. 'Forager' is used to refer to populations who traditionally subsist primarily on hunted, gathered and/or fished resources.
2. Figure 15.1 includes only populations for which dietary data is available. Some populations in Kelly's (2013) dataset are recorded as having equal percentages of two resource types. These populations were designated primary subsistence type based on comparison with Binford's (2001) and Marlowe's (2005) datasets, in which every population has one dietary resource type that is more dominant.
3. Douglas White's recoding ([*systat3recod*]; Johnson 2006) of Binford's (2001: 382) variable was used here (see Table 15.1), whereby 'generic hunter-gatherers' were deemed egalitarian, and those coded with 'instituted leadership', 'wealth-differentiated' or 'stratified or characterised by elite and privileged leaders' deemed non-egalitarian. Four of the 117 fisher-foragers societies were coded as 'horticulturally augmented cases' (the Ket of Siberia, Yaruro [Pumé] of Venezuela, Guato of Brasil and Kaurareg of Australia) and one as 'mutualists and forest product specialists' (the Isabela Agta of the Philippines). These societies were instead classified as egalitarian or non-egalitarian based on the variable [*polyscal*] (an ordinal scale of political development, see Table 15.1), with four (Yaruro, Guato, Isabela Agta, Kaurareg) classed as egalitarian as they exhibited only 'performance based leadership' or 'senior males provide[d] an advisory type leadership', while the Ket were classed as non-egalitarian having 'formal or informal council of advisors with recognized leader' (Johnson 2006).
4. The analyses exclude mounted hunters ([*systat3recod*] =7) for whom the use of horses was considered to bypass typical constraints on traditional (non-equestrian) forager behaviour (especially mobility).
5. This is a relatively crude geographic categorization of foragers (see Table 15.1) in accounting for Galton's problem. For example, the category 'Asia' incudes populations from India to Southeast Asia, Japan and Siberia. However, this system does produce groupings of relatively similar, and not overly small sizes, ranging from 19 (North American Steppic mounted hunters) to 56 (Australian) populations.

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Chapter 16

Unequal in death and in life? Linking burial rites with individual life histories

Rick J. Schulting, Rowena Henderson, Andrea Czermak, Gunita Zarina, Ilga Zagorska & Julia Lee-Thorp

The origins of social inequality have been identified as one of the key 'grand challenges' facing archaeology and indeed the social sciences more generally (Kintigh et al. 2014). The question is one to which archaeology should be very well-placed to make an important contribution, given the discipline's unique access to long-term sociocultural trajectories, long prior to the impact of the colonial enterprise that problematizes many ethnographic accounts of small-scale societies (cf. Ferguson & Whitehead 1992). To realize this potential, however, it is essential to have a set of tools with which to measure social inequality in a robust way. This is far from straightforward, particularly in earlier prehistory, which is of course precisely one of the key contexts within which the origins of inequality are to be sought (Bowles et al. 2010; Hayden 1994, 1995, 1996; Smith et al. 2010). The search has often focused on early farming societies, with their supposed inherent capacity for surplus production (see discussion in Bowles et al. 2010), yet, given the right conditions, it is clear that a considerable degree of inequality can and does emerge among what have been termed 'complex' hunter-gatherers, epitomized by the Northwest Coast of North America (Ames 1994; Hayden 1995; Schulting 2014). A further challenge to this enterprise is the post-processual critique that emerged in the 1980s and 1990s, calling into question the interpretation of the mortuary record – one of the most common means of addressing inequality in prehistoric small-scale societies – as directly reflecting the position of the deceased in life (Hodder 1982). In this paper, we briefly review processual and post-processual approaches to mortuary analysis, before turning to attempts to trace socioeconomic inequality in the funerary record of Mesolithic Europe, noting the difficulties encountered by this endeavour, leading to ambiguous conclusions often open to alternative interpretations. We then explore the use of stable carbon and nitrogen isotope analysis at the Mesolithic/'Neolithic' site of Zvejnieki, Latvia, to link treatment in death with long-term dietary differences in life. While presenting a strong new line of evidence, this is also open to ambiguity in interpretation: the simple identification of difference need not equate with socioeconomic inequality. We explore this connection further through high-resolution sequential stable isotope measurements on tooth dentine, enabling a shift from long-term averaged adult diet to short-term diets through infancy and childhood. While not completely resolving the matter, the results do seem to point to a persistent element of vertical social differentiation, but one that was stable and did not lead to increasing inequality over time.

Mortuary archaeology and the post-processual challenge

One of the foundational tenants of the 'New Archaeology' that emerged in the late 1960s and early 1970s was that aspects of past social organization were retrievable from the archaeological record, and especially the funerary record. Treatment in death reflected – albeit through 'a glass darkly' – aspects of the deceased's position in life. The more elaborate this treatment, the greater importance the individual was held to have had in life, such that their death was a more momentous occasion for the community or wider region than that of other individuals (Binford 1971; Tainter 1978). Thus, the greater the differentiation found in the funerary record – beyond that based entirely on age and sex, seen as universal dimensions of difference in human societies – the greater the social inequality present in the living social system. While this tenet was widely accepted, the details of exactly how to operationalize it were another matter, one widely debated even within early processual archaeology. For example, Tainter (1978) called into question the widespread use of grave goods as a marker of wealth and/or status, noting that other forms of what he termed 'energy expenditure' were much more strongly correlated with social standing in a cross-cultural study of ethnographically documented societies. The problem with this is that many aspects of energy expenditure, such as the number of guests attending the funerary rites and the length of time they are supported by the hosts, would be difficult if not impossible to recognize archaeologically in most circumstances. One response is that redundancy built into the system, which essentially can be seen as social signalling, would to a degree circumvent such issues (O'Shea 1984).

A more fundamental challenge to the processual mortuary programme emerged with post-processualism, which called into question the idea that material culture, including grave goods, reflected real social relationships in any straightforward way (Hodder 1982; Pader 1982; Parker Pearson 1982). Instead, it was proposed that material culture was used by the living to make ideological statements about the dead, which may or may not be related to their 'real' position in life. Supposedly well-defined social roles were contrasted with more fluid notions of social practice creating and manipulating those roles (Parker Pearson 1999). But it is easy to exaggerate this difference: social practice does not operate within a vacuum, and social roles are always in a process of being enacted, so that the two approaches are perhaps better seen as mutually constitutive. If, as both approaches would accept, material culture plays a central role, then the implication is that those with access to certain kinds and/or quantities of material culture will be in a privileged position, no matter whether reflecting, creating, undermining or otherwise manipulating 'reality'.

Following along these lines, and of particular relevance to the case study presented below, the attempt to identify ascribed status from 'rich' child burials – a cornerstone of the processual mortuary programme for some – has also been called into question, with alternative interpretations focusing on the need of the mourners to mark the emotional bereavement felt particularly strongly at the untimely death of a child (cf. Brück 2004; Pader 1982). The problem with this view is that it fails to take into account the fact that while it may be felt by all families, the ability to mark out grief with exotic and high-value objects (as determined by the labour and/or distant social connections required to acquire and/or manufacture them) would not be available to everyone in the community. The objects in a grave can mark the social position of an individual without necessarily being their personal belongings. They may, for example, symbolize the bonds of allegiance that the living held with the deceased, or, in the case of a child, mark a position or role that the deceased would have been expected to attain had they survived. This does not make the associations any less 'real'.

A more nuanced position was taken by Derevenski (2000), who documented the complex interplay between grave offerings, age and sex (gender) in the Late Neolithic and Chalcolithic cemetery at Tiszapolgar-Basatanya in Hungary. Focusing on metalwork, she noted that this and other classes of grave goods came and went as individuals progressed through their life course, arguing that they were being used in the performance of changing age/gender identities. At the same time, Derevenski acknowledged that status considerations could very well be involved in how these identities were materialized. Although not addressed in her study, the advent of first copper and then bronze metallurgy in prehistoric Europe raises another important issue, that of changes in the availability and hence 'cost' of items of material culture, particularly those, such as metals, well suited to making social distinctions in the vertical dimension. In some circumstances the availability of exotic materials can fluctuate sharply even over short time scales, potentially creating a misleading impression of the degree of inequality represented in a cemetery or region unless there is very tight chronological control. Instead, variations in the presence and quantity of such objects may relate to fluctuations in their availability.

Linking burials rites and individual life histories

One powerful response to the legitimate questions raised regarding the 'truth' of the funerary rite in a given context is to link the life history of the interred individual with their mortuary treatment (e.g., Knudson & Stojanowski 2008; Robb et al. 2001). There are two approaches to this, employing osteological and biomolecular methods. Osteological investigations in this context have often focused on a comparison of social status (e.g., as marked by grave goods) and skeletal health indicators, such as linear enamel hypoplasia and adult stature (Larsen 1997, 2002). Body modifications affecting the skeleton (e.g., cranial modification; dental ablation, filing or inlays) are especially difficult to 'fake' and often refer to horizontal and/or vertical social identities (e.g., Sharapova & Razhev 2011; Temple et al. 2011). Skeletal activity markers can also be used to infer particular behaviours. A particularly interesting example is the demonstration that higher status graves, many weapon-bearing, in the Iron Age of Central Italy exhibit greater humeral asymmetry than lower status graves, suggesting the restriction of martial training with swords from a young age to the elite (Sparacello et al. 2015).

The potential of biomolecular approaches to investigate status differences has long been recognized. Stable carbon and nitrogen isotope analysis has featured strongly in this approach, linking the long-term diets (10+ years in adults) reflected in bone collagen and bioapatite to differential mortuary treatment. The most successful case studies have usually derived from chiefdom or state-level societies with distinct social classes (e.g., Ambrose et al. 2003; Knipper et al. 2015; Privat et al. 2002; Ubelaker et al. 1995), wherein dietary distinctions might be expected to play a greater role than in less hierarchical societies (cf. Goody 1982). But there are also a number of examples from the European Neolithic. Using strontium isotope analysis, Bentley and colleagues (2002, 2012) found that males interred with shoe-last adzes in the Linearbandkeramik of Central Europe were more likely to have been born locally than males without such adzes, suggesting that these marked a privileged status relating to residential priority. A number of recent stable carbon and nitrogen isotope studies have identified differences in the Neolithic based on burial location or type within restricted regions of the Iberian Peninsula (Fernández-Crespo & Schulting 2017; Le Bras-Goude et al. 2013; Waterman et al. 2016). Among these is a study in the Middle Ebro valley of north-central Spain, in which small but statistically significant differences in $\delta^{13}C$ were identified between contemporaneous Late Neolithic/Early Chalcolithic burials in dolmens in the valley and those in caves and rockshelters in the nearby foothills, with the sites often being intervisible (Fernández-Crespo & Schulting 2017). The interpretation of these results, however, is again ambiguous. They could refer to a territorial division of the landscape by adjacent communities with different subsistence practices, rather than to socioeconomic inequality within a single society.

Social inequality in Mesolithic Europe

Much of the above discussion has referred to later prehistory or to the proto/historical period. Identifying social inequality in earlier periods presents even greater challenges in terms of operationalization and interpretation. Summarizing the burial data available at the time, Clark & Neeley (1987) argued that there was evidence for both horizontal and vertical social differentiation in the European Mesolithic. But the patterns identified were ambiguous, and this has remained the case in more recent studies. For example, there is a statistically significant tendency at the Breton Late Mesolithic cemeteries of Téviec and Hoëdic for those individuals interred with red deer antler structures to have a higher than average number of other grave good classes (e.g., shell beads, tooth pendants, boar/red deer mandibles microliths, flint blades, red ochre, etc.) than those without such structures. Similarly, graves with bone pins and flint blades were also 'richer' in other artefact categories than those lacking these items, independent of age or sex (Schulting 1996). But how is this to be interpreted? None of the objects are made of materials that would be very difficult to acquire, nor would they be laborious to make. The abundant shell beads are dominated by simply perforated, but otherwise unmodified and locally available cowries (*Trivia* sp.) and whelks (*Littorina* sp.), and the lithic and bone tools appear to be mostly functional. Of course it is possible that these artefacts still do reflect differences in social standing. The placement of antler structures in graves would be very visible to onlookers at the time of the interment, and the bone pins appear to have served to fasten garments (David 2016), and so may have signalled that these individuals were somehow more important than others. But this could be open to other interpretations, and so it is difficult to infer meaningful differences in life from their treatment at death.

Tooth pendants and diet at Zvejnieki

Social signalling is more likely to be found in non-functional items, or in elaborated versions of ostensibly functional items. In the former case, items of dress and 'ornamentation' are prime candidates for creating a visual impression of distinction that would be easily recognized both within and beyond the community (cf. Hansen 2004; Stig Sørensen 1997). A number of large Mesolithic cemeteries in northeast Europe contain burials with numerous animal tooth pendants that appear to have been attached to clothing as well as worn as necklaces and bracelets, etc. One such site is Zvejnieki on the shores of Lake Burtnieks in northern Latvia, where over 330 burials were recovered, spanning the Middle Mesolithic to Late Neolithic, *c*. 7000 to 2500 cal. BC (Larsson & Zagorska 2006; Zagorskis 2004) (Fig. 16.1). It should be emphasized that 'Neolithic' in this context refers to the presence of pottery rather than to the presence of domesticated plants or animals, other than the dog (Loze 1993; Piličiauskas et al. 2017). Thus, the Early Neolithic Narva culture (from *c*. 5300 cal. BC) at Zvejnieki can be thought of as comparable to the Late Mesolithic Ertebølle culture of southern Scandinavia. The few Late Neolithic Corded Ware graves (from *c*. 3200 cal. BC), on the other hand, are contemporary with the introduction of domestic crops and animals in the eastern Baltic (Kriiska 2003) and are isotopically distinct from the earlier periods, showing markedly less evidence for the use of aquatic resources (Eriksson et al. 2003; Meadows et al. 2018;

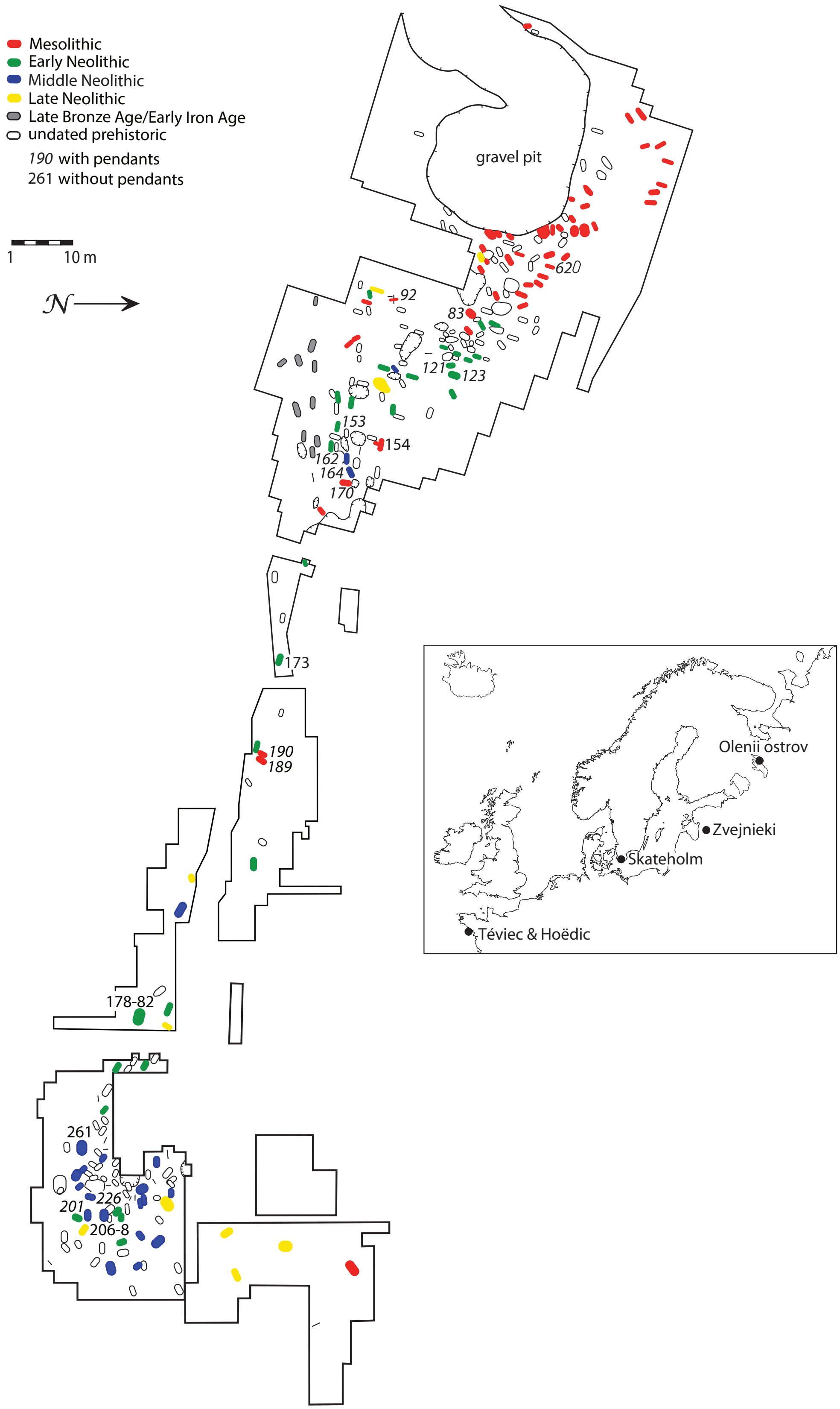

Figure 16.1. *Zvejnieki site plan (after Zagorska 2006, fig. 11).*

Figure 16.2. *a) Zvejnieki burial 170, Mesolithic adult male (photo F. Zagorskis); b) Zvejnieki burial 226, Middle Neolithic child aged 2–4 (photo F. Zagorskis).*

Henderson et al. in prep.). These are omitted from the analysis presented below, which hence refers entirely to the fisher-hunter-gatherer communities making use of Zvejnieki for burial over a period extending over two-and-a-half millennia (*c.* 7000–3500 cal. BC). Also omitted are Early Neolithic burials 178–182, interred in a single contemporaneous mass grave with evidence for a violent death on at least one individual, with the inference being that all may have died violently in a single episode (Meadows et al. 2016). Thus, these individuals may have been accorded a different burial treatment reflecting their manner of death (cf. Binford 1971).

Many of the graves at Zvejnieki were richly provisioned with animal tooth pendants, predominantly of boar, red deer, elk, bear, wild horse and wolf/dog, totalling over 2400 teeth (Fig. 16.2). Other grave goods include various bone and flint implements, carved figurines, copper rings, and amber discs placed over the eyes (Larsson & Zagorska 2006; Zagorskis 2004). Importantly, there is abundant evidence for the wearing of the tooth pendants in life, as seen in the redrilling of suspension holes and reworking of grooves worn through by use (Larsson 2006). Thus, they formed

Table 16.1. *Summary of bone/bulk tooth dentine and sequential collagen results from Zvejnieki (data from Eriksson 2006; Eriksson et al. 2003; Henderson 2015; Henderson et al. in prep.; Meadows et al. 2018). Calibration of the radiocarbon dates is complicated by a freshwater reservoir effect (Meadows et al. 2018), taken into account in the broad ranges considered here. Note that the Mesolithic results exclude the M1 from Grave 170 as an outlier, and that the Early Neolithic results exclude individuals from a mass grave.*

	Bone/bulk dentine					M1 dentine				
	δ13C ‰		δ15N ‰			δ13C ‰		δ15N ‰		
Period	**x̄**	**SD**	**x̄**	**SD**	**n**	**x̄**	**SD**	**x̄**	**SD**	**n**
Mesolithic (7000–5200 cal. BC)										
with pendants	-22.7	1.0	11.8	0.6	10	-22.3	1.0	10.8	0.1	2
without pendants	-23.4	1.4	13.2	1.3	6	-23.8	0.1	13.6	0.9	2
Early–Middle Neolithic (5200–3500 cal. BC)										
with pendants	-22.6	1.4	11.6	1.0	10	-22.8	0.4	11.7	0.3	5
without pendants	-23.0	1.0	12.6	0.6	6	-23.3	1.1	13.1	1.5	3
Mesolithic–Neolithic (7000–3500 cal. BC)										
with pendants	-22.7	1.3	11.7	0.9	20	-22.6	0.6	11.3	0.5	7
without pendants	-23.2	1.2	12.9	1.0	12	-23.5	0.8	13.3	1.2	5
large herbivores	-23.0	1.0	5.4	0.9	18					
wild boar	-23.5	0.6	6.3	1.3	9					
brown bear	-21.2	1.4	7.3	1.2	4					
fish	-24.7	3.4	9.3	3.0	5					

part of an individual's attire, which is crucial to the notion that they were used for social signalling. The pendants, then, in addition to being ornaments in themselves, also serve as a proxy for a wider range of associated dress in organic materials that have not survived. Moreover, O'Shea & Zvelebil (1984) argued that animal tooth pendants in graves marked the greater prestige and 'wealth' accorded to hunters at the large Mesolithic cemetery of Olenii ostrov in Karelia, northwest Russia, a site in many ways comparable to Zvejnieki (Fig. 16.1). Again emphasizing difficulties in interpretation, the link between hunting and prestige was subsequently challenged by Jacobs (1995), who found no pattern linking treatment in death with life histories, as indicated by long-bone robusticity and trace element analysis.

Previous studies have reported $\delta^{13}C$ and $\delta^{15}N$ results for bone and bulk tooth collagen at Zvejnieki (Eriksson 2006; Eriksson et al. 2003; Meadows et al. 2018). These have been considered in terms of age and sex, but not status or identity as indicated by grave goods. The graves analysed include those both with and without tooth pendants. As these form by far the most ubiquitous artefact class, they can be used to explore the possibility of long-term dietary differences related to their presence or absence. While the preferred species from which the pendants were made changed over time (Larsson 2006), the available radiocarbon dates do not otherwise suggest any chronological trend in the practice of placing pendants in graves, which could otherwise confound the analysis (i.e., informing on diet change over time rather than variability at any given time) (Fig. 16.3). In absolute numbers, the graves with tooth pendants that have been analysed isotopically contained between 1 and 339 pendants, with a mean of 69 per grave (median = 27). The Mesolithic graves with pendants average 11.8 ± 0.6‰ in $\delta^{15}N$ (n = 10), whereas those without pendants average 13.2 ± 1.3‰ (n = 6). For the Early and Middle 'Neolithic', these figures are 11.6 ± 1.0‰ (n = 10) and 12.6 ± 0.6‰ (n = 6), respectively. The combined Mesolithic-Neolithic samples average 11.7 ± 0.9‰ for the burials with pendants (n = 20), and 12.9 ± 1.0‰ (n = 12) for those without (Table 16.1). The data are normally distributed (Shapiro-Wilks, $p > 0.05$) and the difference is statistically significant (Student's t-test, $t = 3.58$, $p = 0.001$) (Fig. 16.4). Thus, it can be inferred that those interred with pendants, irrespective of their absolute number, had long-term diets that made greater use of lower-trophic-level sources of protein. In the context of the Lake Burtnieks, this is most plausibly interpreted as a greater reliance on terrestrial rather than aquatic fauna (plant foods are unlikely to have contributed significantly in terms of protein at this latitude, and it is only the protein component of the diet that is measured by $\delta^{15}N$). This is supported by isotopic measurements on fauna from the site itself (Eriksson 2006; Eriksson et al. 2003).

No comparable trend can be supported statistically for $\delta^{13}C$, although values are in the expected direction,

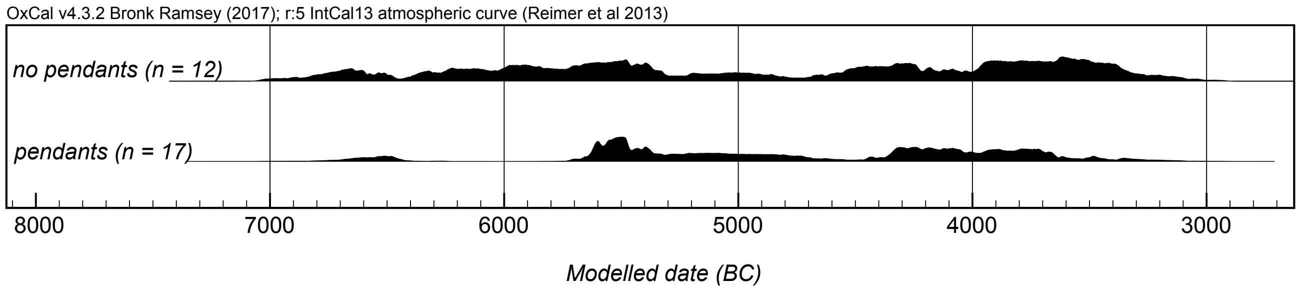

Figure 16.3. *Summed probability distributions of radiocarbon dates for those buried with and without tooth pendants, taking into account estimated freshwater reservoir corrections (data from Meadows et al. 2018).*

i.e., lower in the group lacking pendants, given that the few lake fish that have been measured from the lake are slightly ^{13}C-depleted compared to terrestrial herbivores (Table 16.1). That the difference is not more marked is likely due to the high variability in δ^{13}C values of aquatic species from Lake Burtnieks, which in addition could include migratory waterfowl and anadromous salmon, both of which were recovered at the site. The δ^{13}C value for a single mallard duck, for example, is much higher at -17.6‰ than most fish from the lake (although a fish bone not identified to species measured -18.6‰). Salmon would be expected to have values at least as high, even given the ^{13}C-depleted waters of the eastern Baltic compared to those of the North Sea.

While the identified pattern appears robust, its interpretation is another matter, as it may be reflecting either vertical or horizontal social differentiation. It may be, for example, that individuals within the community chose to specialize either on fishing or on hunting, with the hunters consequently having greater access to animal tooth pendants for themselves and their kin. Alternatively, the cemetery may have been used by distinct communities practicing complementary subsistence strategies, with one focused more on the lake and its resources, and the other more on the surrounding terrestrial habitat. Their use of a shared burial ground (while there is a shift in the location of burials within the cemetery over time – see Fig. 16.1 – there is no discernible chronological difference in the radiocarbon dates for those with and without pendants – see Fig. 16.3) could imply that the two economies were integrated at some level, suggesting

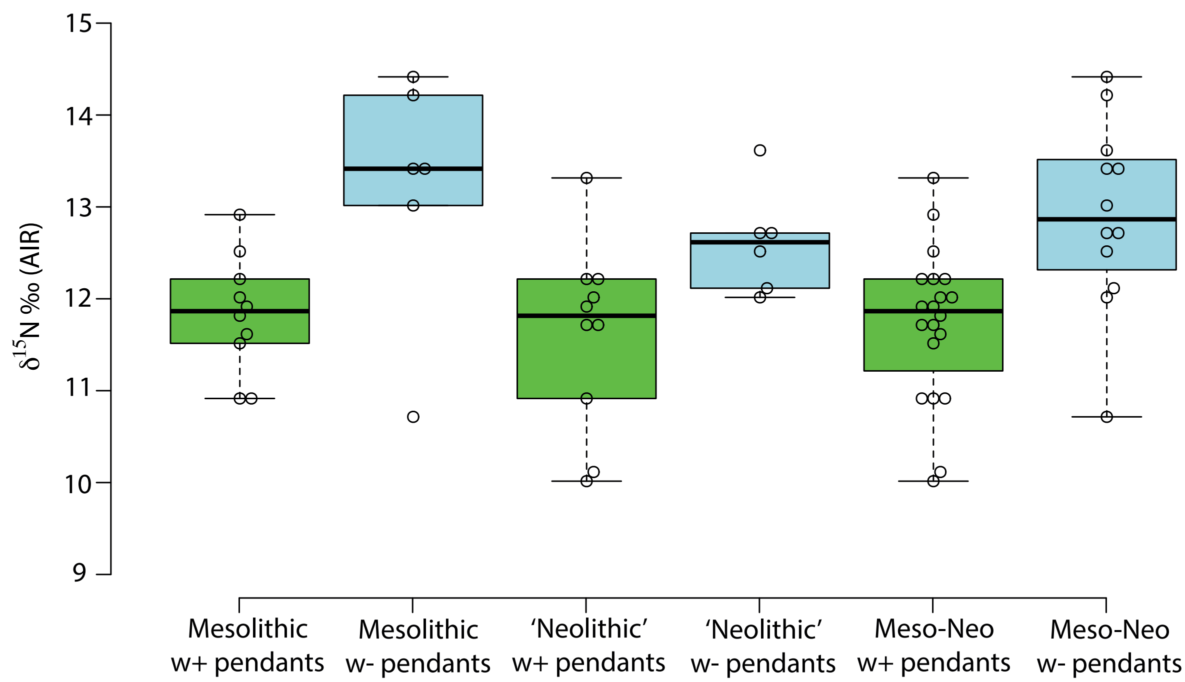

Figure 16.4. *Human bone collagen δ^{15}N values for Mesolithic and Early/Middle Neolithic graves at Zvejnieki with and without animal tooth pendants.*

that food exchanges likely took place, but not to the extent that obscured overall dietary differences. The distinct identities of the two communities would be marked by the use of tooth pendants and associated dress by the more terrestrially oriented group. Both scenarios might be seen as rather surprising in a hunter-gatherer context, since even when a degree of economic specialization exists, based on individual skills and propensities, the high degree of food sharing that is often seen as a hallmark of hunter-gatherers (Bird-David 1990; Cashdan 1985; Gurven 2004; Kelly 2013; Woodburn 1982, 1998) would be expected to obviate dietary differences over the long term. On the other hand, this characterization applies mainly to hunter-gatherers at the 'simple' forager end of the spectrum. Sharing may be rather less ubiquitous among 'complex' hunter-gatherers, who are often more reliant on aquatic resources and exhibit greater sedentism, reliance on storage, and higher population densities (Binford 2001; Hayden 1994, 1995, 1996; Kelly 2013; Schulting 2014).

One means of taking the analysis at Zvejnieki further is through sequential sampling of tooth dentine, which allows a relatively high-resolution examination of diet through infancy and childhood (Beaumont et al. 2012). This addresses the question of when during the life course of an individual isotopic/dietary differences first appeared. The method has predominantly been used to investigate weaning age (e.g., Eerkens et al. 2011; Henderson et al. 2014; Fernández-Crespo et al. 2018), and indeed a comparison of weaning age in hunter-gatherers and later societies was one of the original aims of the sequential sampling study conducted on first permanent molars from a subset of the same skeletons from Zvejnieki for which bulk stable isotope results were already available (Henderson 2015). The roots of first molars develop from approximately ages 0 to 8 years (AlQahtani et al. 2010). Here, we compare the average post-weaning isotopic values for ages 3 (by which age weaning appears to have been complete) to 8. For most individuals measurements on 4–5 sequential samples have been combined; for one (Grave 123) only two measurements are available as the tooth roots were not yet complete. Full details of the analysis are presented in Henderson (2015) and Henderson et al. (in prep.).

Excluding one outlier (Middle Mesolithic Grave 170, with an anomalously high $\delta^{15}N$ value of 15.7‰, nearly five standard deviations above the mean value for other individuals with pendants, and with a much lower adult bone collagen value of 11.8‰), there is again a clear difference in the isotopic results for those with pendants, averaging 11.3 ± 0.5‰ (n = 7), compared to those without pendants, averaging 13.3 ± 1.2‰ (n = 5). Given the smaller numbers involved, we have not analysed the Mesolithic and 'Neolithic' individuals separately, but the two periods are represented in both groups (Table 16.1). The $\delta^{15}N$ dentine results are statistically indistinguishable from those on bone collagen so that again those with and without pendants differ significantly (heteroscedastic Student's t-test, $t = 3.35$, $p = 0.020$) (as with the bulk collagen, there is no significant difference in $\delta^{13}C$ values) (Fig. 16.5). The same pattern persists if we consider only the dentine samples referring to ages 3–4. Since children of this age cannot have been engaged in subsistence pursuits in any serious way, the implication is that they were being provisioned by their parents, and hence that economic specialization was held and passed down either within families, or within communities if, following the above discussion, the site served as the burial place for different communities. Either way, it is striking that this pattern appears to have persisted over two-and-a-half millennia (Fig. 16.3). It should be emphasized that we are not suggesting on the basis of the isotopic data that either group lacked sufficient food for adequate health, though whether they experienced differences in the levels or timing of physiological stress is certainly an avenue worth exploring.

Social inequality at Zvejnieki?

The association between the presence of tooth pendants and significantly lower $\delta^{15}N$ values from early childhood continuing into adulthood at Mesolithic-Neolithic Zvejnieki presents an unexpected relationship, one not previously observed for Mesolithic Europe as far as we are aware (interestingly, Scharlotta et al. (2016) noted a relationship between the presence of animal tooth pendants and *higher* $\delta^{15}N$ values at the large Early Neolithic hunter-fisher gatherer cemetery of Shamanka II on the shores of Lake Baikal, i.e., the opposite trend to that seen at Zvejnieki). But is this social inequality? We have identified difference, and demonstrated that treatment in death can be related systematically to a meaningful divergence in the foodways and hence life experiences of individuals interred with and without tooth pendants. This is an important finding, but to suggest that it can be equated with social inequality requires additional support. As noted above, the pattern could just as easily be explained by horizontal social differentiation as by vertical status distinctions – which is not to intimate that the former is inherently less interesting or less worthy of study. Tracing its existence back into early childhood, while adding significantly to our understanding, does not resolve this fundamental issue.

While over half the graves at Zvejnieki contained no grave goods (or at least none made of non-perishable

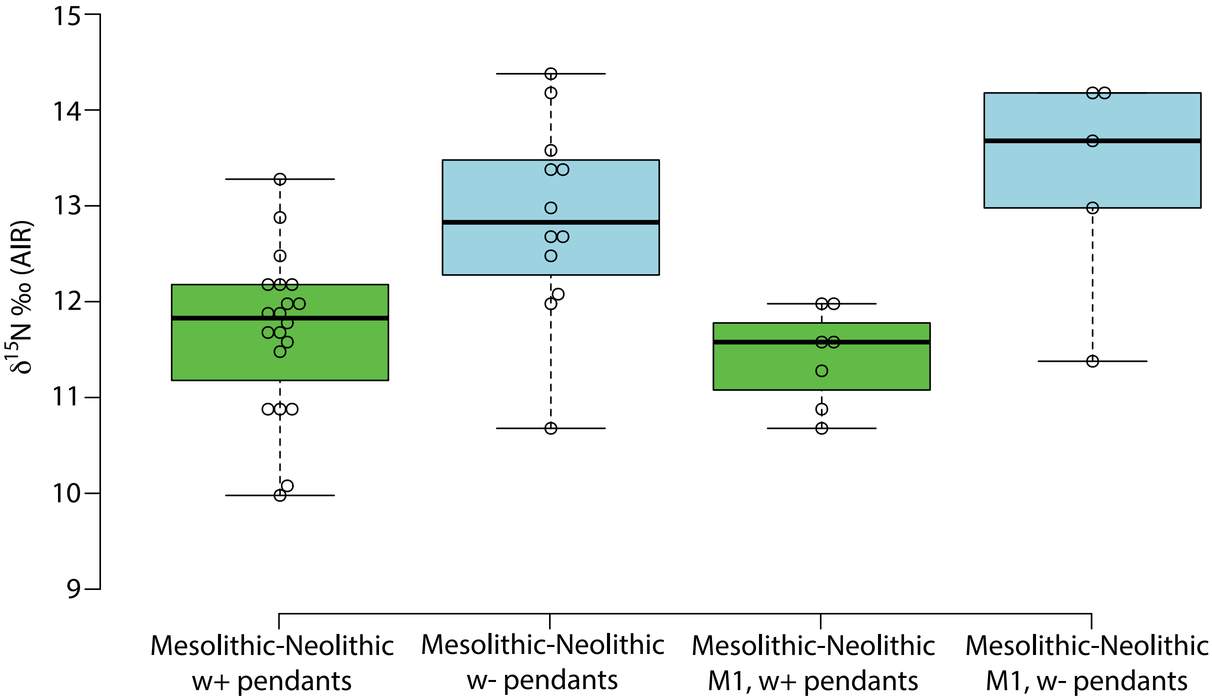

Figure 16.5. *Human (left) bone collagen and (right) post-weaning M1 dentine $\delta^{15}N$ values for Mesolithic and Early/Middle Neolithic graves at Zvejnieki with and without animal tooth pendants.*

materials) (Zagorskis 2004: 51), very few of these have been included in the individuals selected for stable isotope analysis, so that at present it is not possible to compare results for those with and without grave goods. Obviously this would be of great interest for a future study. Three of the analysed graves lacking tooth pendants included amber, as did a number with pendants. Whether amber should be understood as a high value item is perhaps debatable in the context of the Baltic, where it is relatively common, though certainly its placement over the eyes of the deceased in some cases suggests that it was perceived as special. Mesolithic graves 86, 93 and 122 with tooth pendants also had stone settings but little else (e.g., a bird bone in one case), whereas graves 39 and 154 had stone settings but no non-perishable grave goods. Overall, then, there is little sense that those graves with tooth pendants are 'richer' in terms of other objects. Indeed, more recent excavations at Zvejnieki recovered one of the richest graves at the site, dating to the Middle Neolithic and containing an adult female and an adult male skeleton, with the former accompanied by two large amber rings, 113 perforated amber beads, as well as a number of beads made from mammal and bird bone, but lacking tooth pendants (Nilsson Stutz et al. 2013).

This brings us back to the pendants themselves, and, perhaps more importantly, to the clothing with or on which they would have been worn. As noted above, clothing and its associated ornamentation can act as a highly visible marker of social distinction, and this extends to ethnographically documented hunter-gatherers. Among the Thompson Indians of the Interior Plateau of British Columbia, for example, tailored deerskin clothing was limited to the wealthier members of society, and served to distinguish them from those of lower socioeconomic standing (Hayden & Schulting 1997; Teit 1900). A series of late nineteenth and early twentieth century photographs show Plateau individuals wearing such clothing, often elaborated with other materials including shell beads, animal teeth and feathers (Tepper 1987). Hunting was a source of prestige among those Plateau groups, including the Thompson, that were heavily reliant on anadromous salmon. Salmon served as a staple food, especially during the winter, when people depended on stored fish taken in the large autumn runs. While hunting was considered a skilled activity, it was if anything even more important to have the aid of spirit helpers. Not everyone had such spirit helpers, while some individuals had many. This conferred a spiritual and moral superiority that became the explanation for greater hunting success, as well as success in other activities, whether overtly economic or otherwise (Schulting 1995: 50–2; see also Watanabe 1983). Thus, in Plateau culture as well as elsewhere, there was often no clear division between the economic sphere and those of ritual and power.

Obviously this is a distant comparison in both space and time, but nevertheless the parallels are worth considering. In both cases we see a considerable reliance on fishing as a staple part of the diet, as well as the importance of hunting, both for subsistence and possibly also for prestige. The common link between hunting and prestige (cf. Gurven & von Rueden 2006) is one that receives further support from a consideration of the ecology of terrestrial and aquatic resources. Where they occur and the technology exists to capture them, large mammals are invariably the highest ranked resource (cf. Hawkes et al. 1982). Thus, the implication is that, even if marking a primarily horizontal division into families (and clans?) specializing on aquatic resources and those focusing more on large game, this distinction would likely lead to their differential ranking, one recognized in the society itself. This is often the case with horizontal differentiation into groups of ostensibly equal standing (Blau 1977). But against this interpretation of two distinct communities is the fact that there is no clear spatial clustering of graves with and without tooth pendants at Zvejnieki, such as might be expected with a clan-based social organization (cf. Binford 1971; Kingsley 1985; O'Shea 1984; O'Shea & Zvelebil 1984). This suggests that an element of vertical status differentiation may indeed be involved.

The observed link between diet and tooth pendants seems to have been maintained in a similar way over more than two millennia, without leading to more overt status differences. To some extent the system may have been self-regulating, since large mammals do not respond well to increased hunting pressure. At the same time, internal checks on overhunting would have maintained the activity's prestige value. A not unrelated means of achieving this end would be through levelling mechanisms, by which those individuals making what are seen as excessive claims over economic and/or social resources are kept in check by the rest of the community (Wiessner 1996). This may take the form of public ridicule, refusal to share, or 'voting with one's feet'. The latter option, however, becomes less viable with more spatially restricted resources such as those obtained from Lake Burtnieks. More extreme cases may see a resort to violence. This recalls the Early Neolithic mass grave at Zvejnieki containing four adult males and one indeterminate adult. One of the males has an arrowhead embedded in a thoracic vertebra, and it is possible that the others were also killed and interred in a single event (Meadows et al. 2016). While this group lacks grave offerings, it is interesting to note that their bone collagen $\delta^{15}N$ values average $11.7 \pm 0.5‰$, much closer to the Neolithic group with pendants than to those without pendants. If these individuals were indeed killed violently, it may be that they were a group of hunters who trespassed in some way, whether physically or socially.

Conclusions

One of the main tasks of archaeologists is pattern recognition. In this paper we have focused on one particular case study, the prehistoric hunter-gatherer cemetery of Zvejnieki in northeastern Europe (Henderson et al. in prep.). A very striking and persistent pattern was highlighted, linking the presence or absence of animal tooth pendants in graves with long-term dietary histories, over millennia of use of the site. But recognizing a pattern is relatively straightforward; the real challenge lies in its interpretation, including a full and honest consideration of the possible alternative explanations. We have presented a plausible case for early socioeconomic inequality before farming in prehistoric Europe. It is not definitive, but the implications are nevertheless worth pursuing. One of these is that we are likely seeing only the proverbial tip of the iceberg. This is partly because isotopic studies of prehistoric hunter-gatherers have generally been concerned with characterizing a group's overall diet, or at most with comparing age and sex (for an exception see Scharlotta et al. 2016). But probably a more important issue is that, even if they exist, many dietary distinctions will not be visible isotopically, since they involve foods with similar isotopic signatures (e.g., different cuts of meat). This makes cases like Zvejnieki all the more important, as it is unlikely that this was a unique situation. There are a number of large cemeteries in the European Mesolithic, with a strong tendency to be situated on the coast, lakes, and major rivers with access to aquatic resources.

Finally, it is worth commenting on the apparent resilience of the social-ecological system at Zvejnieki (cf. Folke 2006). This was maintained (e.g., there is little evidence for high hunting pressure on large game) in a way that suggests that it was very stable, and apparently did not lead to attempts by those of putatively higher status to expand their control, or, if it did, then they were unsuccessful. Exploring the reasons for this falls outside the scope of this paper, but are likely to relate to the ecological restrictions on intensifying hunting, as well as to social levelling mechanisms. Social inequality always implies a tension between competing interests, one that in the case of Zvejnieki seems to have reached a long-lasting, stable balance that did not lead to escalating inequality.

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Chapter 17

Did prehistoric people consider themselves as equals or unequals? A testimony from the last hunter-gatherers of the Eastern Sahara

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The aim of this edited volume is to present the views of archaeologists and anthropologists on the existence of inequalities before farming. In this regard, this chapter differs slightly, trying to explore inequalities not as we ourselves perceive them, but as we understand prehistoric people's own perceptions and expression of difference through rock art. Even though it is tempting to see the direct transcription of scenes of everyday life in the 'domestic' representations that abound in Saharan rock art, rock art is not a collection of snapshot pictures of past societies. Any reality is the result of an individual and collective perception of the world (Schrödinger 1967: 93; Watzlawick 1976). In attempting to present a 'phenomenology of the perception of inequalities' in this paper, the founding principle is that rock art is not to be considered as the exact depiction of past reality, but rather as the depiction of a reality as it has been conceived in the mind of the painters. There is nothing new in saying that our worldviews, in the sense of 'human decryptions of reality', have been deeply modified since the onset of farming (Dilthey 1883: 216, 460; Ingold 1994: 11; Descola 2005: 10; Barker 2006: 57–60). This chapter therefore addresses the difficulty of studying social inequality through the archaeological lens and tentatively explores new ways of studying social differentiation through a case study which applies a sociological approach to group depictions. A corpus of 70 painting units with human representations has been studied, all made by hunter-gatherer groups around 6000 BC on the same rock surface. This site, the Wadi Sūra II shelter in southwestern Egypt (Fig. 17.1), is one of – if not the – most important rock art sites in Africa, due to the number of superimposed paintings: 8000 counted by the Cologne project (Leisen et al. 2013: 45). In interpretations of these paintings of human groupings, emphasis has sometimes been placed on equality, with figures depicted in a strictly similar way, and sometimes on differentiation, with what can be called 'individualizing' markers. Such markers, their absence or presence, context and association with other elements in rock art are explored here, not with the aim of determining whether the painters themselves were living in egalitarian or inegalitarian systems, but instead to understand, (1) how they conceived of equality or inequality in their social lives, (2) to what extent they represented themselves with signs of sameness or difference, and (3) how we can understand the emphasis placed on either equality or inequality in group depictions.

Studying social inequality through the archaeological lens

In their introduction to the volume *Pathways to Power*, Douglas Price and Gary Feinman have emphasized the particular contribution that archaeology can bring to the study of the emergence of social inequality because of 'the time depth available' (Price & Feinman 2010: 1). At the same time, we are forced to acknowledge that archaeology is, by and large, a myopic discipline: the further we go back in time, the less clear our view is. In Palaeolithic archaeology, there is a still an irreconcilable coexistence of the relatively good insight that can be reached at the level of a site, and the fragmentary nature of our understanding of prehistoric societies and cultures. Perishable materials are often lacking in the archaeological record and we have to reconstruct practices and activities from only a small portion of what we call 'material culture'. More challenging still is that the majority of human activities do not create positive evidence. Yet, having been built as an evidence-based discipline, archaeology still puts forward the idea that archaeological cultures can be defined as material cultures (for a discussion on the relevance of the concept of 'archaeological cultures', see Roberts & Vander Linden 2011).

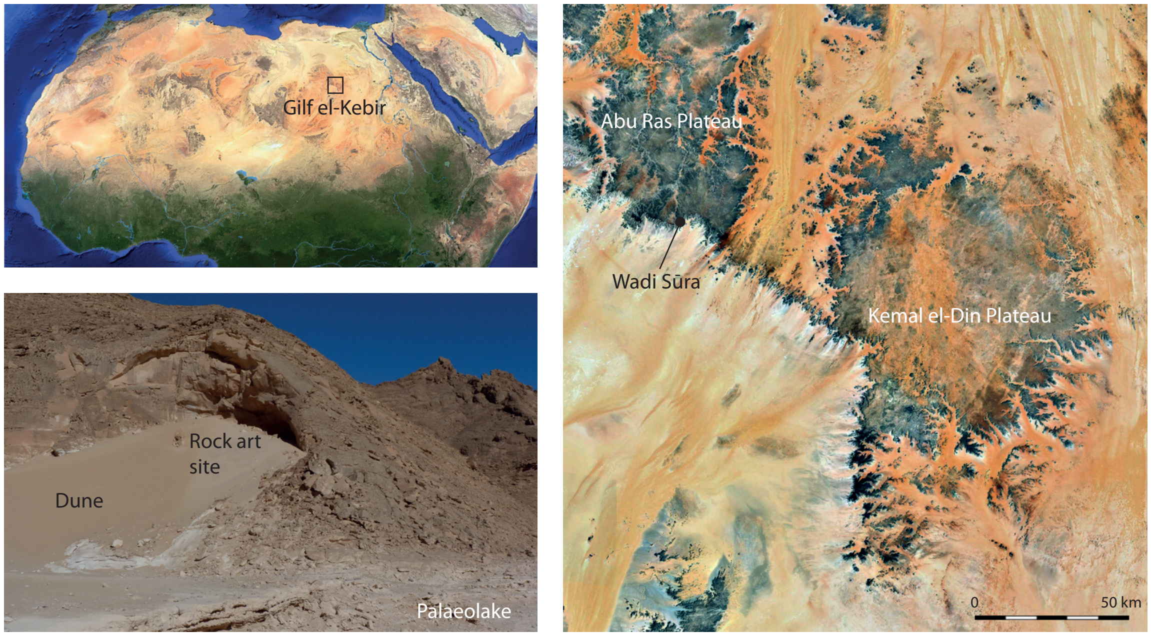

Figure 17.1. *Location (a, b) and setting (c) of the rock art site of Wadi Sūra II. Satellite imagery from Google Earth Pro 7.3.*

Archaeology aims for a holistic understanding of past human societies and cultures *lato sensu* based on their material remnants, and scientific integrity forces us to state that a large portion of these material remains are non-existent. Social organizations are by definition complex bundles – even when they are described as simple – involving sets of relationships and entanglement. Exploring them with archaeology is a difficult undertaking, for which we have to accept many inherent limitations. As underlined by Boris Valentin and François Bon, 'it is still a serious challenge to pretend that we can reconstruct social organizations in more than just very general terms' (Valentin & Bon 2012: 176). It is not surprising that all classification systems of societies formulated by anthropologists are based on their observations of a set of criteria in the social life within current and well-documented groups. In archaeology, we never have direct access to what have been called social 'systems' by structuralists and their followers (Lévi-Strauss 1958): we only access partial – and often distorted – residual evidence of it. Any attempt at classifying past societies implies the use of metonymical reasoning: one element from the material evidence has to represent the whole system.

An essential question lies at the heart of the study of social inequality through archaeology: what are the archaeological traces of social equality or inequality? How can material evidence demonstrate social inequality? Are differences in wealth the best proxy indicator? Behind the evolutionist paradigm, there is a more-or-less explicit consensus in the anthropological and archaeological research community that every hunter-gatherer society would have existed primarily in a state of equality and that social inequality would have emerged progressively. As a matter of fact, the debate focuses more on 'when and where' inequalities emerged, with each scholar seeing the signs of decisive steps towards inequality in their own period of interest (Jeunesse 1996; Van de Velde 1990). In the Palaeolithic record, grave goods and personal ornaments in funerary contexts have been seen as evidence of inherited social ranking, from Sunghir (White 1999; Flannery & Marcus 2014: 13) to La Madeleine (Vanhaeren & d'Errico 2001) and Saint-Germain-la-Rivière (Vanhaeren & d'Errico 2003). The detection of social inequality through material differences is based on a positivist tendency, assuming that social life can be described by 'laws' based on hard scientific evidence (Inglis & Thorpe 2012: 29). Such interpretation of the Palaeolithic record relies on the double premise that: (1) wealth inequalities translate proportionally to social inequalities (and, *a fortiori*, social stratification), which anthropologists have demonstrated as being not a rule in every society; and that (2) inequalities in death equate to inequalities in life. The degree to which inequalities are materialized does not necessarily nor directly reflect the degree of inequalities in a given society: there is often simplification or distortion, and wealth differences may not have a solely social meaning. More widely, in the reconstruction of prehistoric social systems, we generally assume that material evidence reflects social functioning, even though the material culture left by a society should not be viewed simply as the direct and exact transcription of social structures – the conclusions of this chapter partially explain why.

Classifying past societies as egalitarian or inegalitarian

Perhaps as a consequence of the necessary shortcuts mentioned above, most archaeological literature implicitly seeks to identify a single point on an artificial line that ranges from complete egalitarianism to the highest degree of inequality, presupposing that societies can be classified according to a defined complexity level. Is this opposition between egalitarian and inegalitarian societies always valid in archaeology? Of course in general, we can debate whether social models elaborated from ethnographic data can be directly applied to archaeological cases. The question has been posed more specifically during the last twenty years and some authors have given different answers. Brian Hayden has proposed an adaptation of this rather dualist model with the addition of another category, a kind of trans-category, the 'transegalitarian society' that could be placed between the egalitarian society and the inegalitarian society, exhibiting traits of each (Hayden 2013). Other authors such as Gary Feinman, with Kent Lightfoot and Steadman Upham, contributed strongly to this question in demonstrating that hierarchy and equality have the potential to coexist simultaneously in many human societies (Feinman et al. 2000). For example, in prehistoric Pueblo political organization of the American Southwest, the entanglement of so many forms of hierarchy creates a kind of equilibrium in the respective power of the different social groups, with the result that no single group dominates the others. Equality versus inequality thus seems to be neither a systematic nor a universally valid dichotomy. The rock art of the last hunter-gatherers brings an additional contribution to this question, displaying the apparent coexistence of expressions of equality and inequality.

Case study: rock paintings of the Eastern Sahara

The material for this archaeological case study is the rock art of the Eastern Sahara, in the Egyptian part of the Libyan Desert, now one of the hottest and most arid points of the globe. The Gilf el-Kebir plateau is a rocky massif overlooking large flat sandy plains. Like other Saharan massifs, this place has been attractive for prehistoric people during the last climatic optimum, from about 9000–8500 BC to 3500 BC. During this interval, favourable ecosystems flourished at the edge of the plateau in the micro-valleys called *wadis*, their geomorphological setting naturally retaining water. Archaeological evidence testifies to the re-peopling of the region during this limited period of the Holocene. During this period there was a major transition: from purely hunting and gathering economies to mixed pastoralist and hunting and gathering ways of life. Partly due to the intense wind erosion, archaeological research in the area has not yet found any funerary evidence.[1] However, the prehistoric groups who evolved in the region have left a large amount of rock art: 402 sites with engravings and 456 sites with paintings have been recorded so far in the Gilf el-Kebir and Jebel el-'Uweināt region (Zboray 2013: 18).

There is a remarkably high density of these sites in a specific part of the northern plateau of the Gilf el-Kebir, which contains the two major sites of Wadi Sūra I and Wadi Sūra II. It is no exaggeration to say that Wadi Sūra II is one of the most – if not the most – important rock art site of Africa, with nearly 8000 paintings. The site is at the top of a dune overlooking a playa, a dried up former temporary lake (Fig. 17.1). It is a naturally curved rock wall of 20 m long. Although it was called the 'cave of beasts' by the University of Cologne team who excavated the site and completed the photographic record and publication of the rock art (Kuper 2013), it is a proper rock shelter (Figs. 17.1 & 17.2). Regarding chronology, since direct dates are lacking, a number of lines of evidence[2] mean this shelter can be considered as having been painted by hunter-gatherers around 6000 BC. This is not the case for most sites in the region which can be assigned with no doubt to the pastoral period. In actual fact, the age of the Wadi Sūra II paintings is better viewed as a chronological range than a precise moment, as the rock surface is a palimpsest of many superimposed layers of paintings (Watrin et al. 2008). This paper is based on direct observation of the rock art of Wadi Sūra II, personal records and published records.

The variety of motifs at Wadi Sūra II is extensive and one specific feature of this rock art is the very high number of human representations, strikingly different from the repertoire of the European Palaeolithic cave art (Fig. 17.2). So far, this potential has remained untapped as the majority of studies focus instead on the mythological content of paintings such as the 'beasts' or the so-called swimmers (Le Quellec 2008, *inter alia*). In contrast to previous work, this chapter aims to study social differentiation and interaction by applying a sociological approach to group depictions. The large number of scenes depicting human figures in group interactions tells us something about how the

Figure 17.2. *Main panel of rock art depictions on the left of Wadi Sūra II walls. The picture has been taken before two metres of sand filling was removed by the excavation team from the University of Köln. Colour balance has been modified for the purpose of visibility.*

painters perceived social interactions between people. For this case study, 70 painting units depicting at least one individual have been identified on the main central panel of the shelter, among which 66 painting units have at least two individuals and can therefore be called 'group scenes'. The coexistence of such a quantity of group scenes on one rock art panel is extremely rare, if not unique, at a global scale. Not all depictions are of the same style and were probably been done at different moments, but they all can likely be attributed to the last hunter-gatherers of the Eastern Sahara.

It appears that the painters have depicted human groups sometimes with signs of equality (or absence of signs of inequality) and sometimes with signs of difference (or absence of signs of equality). In some scenes, all individuals are depicted in a strictly similar way, with the same size, colour, body shape, etc., whereas in other scenes, markers of individuality can be detected. No blind correspondence is to be established with the degree of equality or inequality of the painter's group. All factors potentially explaining the emphasis on equality in some scenes and inequality in others have to be explored. For this study, a catalogue of the 70 scenes involving at least one human figure has been made detailing for each: the number of individuals, the presence or absence of means of individualization, the nature of the means of individualization (size, colour, physical attributes, body ornaments, equipment), the difference or similarity of the postures of individuals in each scene, and the activity performed by the group. Both statistics and qualitative research methods are employed to detect potential patterns. The objective is to explore this corpus of collective scenes as a sociologist would do for a panel of human groups.

Conception and depiction of equality and inequality among the last hunter-gatherer groups

The activities performed are very diverse, some of them not being precisely identifiable. They can be classified into nine types: hunting, fighting, running, standing with no possibility of determining the activity more specifically, standing side by side, domestic activities, dancing and music-playing, ritual performance and scenes involving the fantastic figure of the composite beast (Fig. 17.3). The number of group scenes is very high: on 70 painting units with at least one human figure, only four display a single individual. It could therefore be said that more than 94 per cent of the painting units involving at least one human figure show group scenes. This echoes the fact that human figures represent a high proportion in the overall range of motifs on the Wadi Sūra II wall (Fig. 17.5).

The average number of individuals per group is between eight and nine. Scenes in which human figures are individualized show an average of seven figures, whereas scenes in which figures are not individualized display an average of more than nine figures. We could expect that the greater the number of human figures is in a scene, the less individualized they are, as if individuality would dissolve in the crowd or as if painting individuality would be done with greater care when a scene takes less time to be represented. One striking example for such a process of simplification is the scene where a composite beast is superimposed on a crowd of 60 oversimplified human figures resembling arrows or crosses rather than normally constituted people (Fig. 17.3). However, at the scale of the whole corpus there is no established correlation between the number of figures and the presence or absence of signs of individualization on the figures. Of the 66 scenes with 2 to 104 figures involved, point-biserial correlation between the two variables is $r = -0{,}131$ and biserial correlation is $r = 0{,}164$. Essentially this means that, from a statistical point of view, no link can be established between the number of figures and an increasing or decreasing tendency to individualize them. So why do some figures show signs of individualization and why do others not?

A further statistical test allows us to demonstrate a correlation between the presence or absence of individual markers and the presence or absence of differences in the posture of the human figures composing each scene. Based on the corpus of 66 group scenes, a Pearson's chi-square test between these two series allows us to reject the null hypothesis. With an error-margin of one per cent, it can be concluded that differences in individual postures are linked with the individualization of figures by physical means. Thus, it seems that the emphasis on individuality is not completely incidental. On the base of this correlation, it can be hypothesized that there are some scenes where individuality does not matter much since everyone has a similar role in the performance, but there are other scenes where specific roles are given to specific individuals in the performance. As differing postures are often found with differing bodies (different size, colour, physical attributes, body ornaments, equipment), there is an expressed intention, in the depiction of such scenes, to specify what each specific person is doing.

This correlation can be visually observed on the graph showing the score of scenes involving individualization markers and the score of scenes involving differing body postures, both weighted according to the number of people involved in each scene[3] (Fig. 17.4B). Patterns can be observed in the expression of individuality, which varies according to the activity performed by the group. Individualization markers are least often expressed in scenes depicting dance and music performance, rituals and in 'mythological' scenes involving the figure of the composite beast. In the life of prehistoric groups, these activities could be the moment when cohesion is expressed the most. The

Figure 17.3. *A scene on Wadi Sūra II walls showing a composite beast in the centre superimposed on a crowd of simplified human figures. The two grey tones correspond to two red ochres. Oblique lines show areas where later motifs obliterate the composition.*

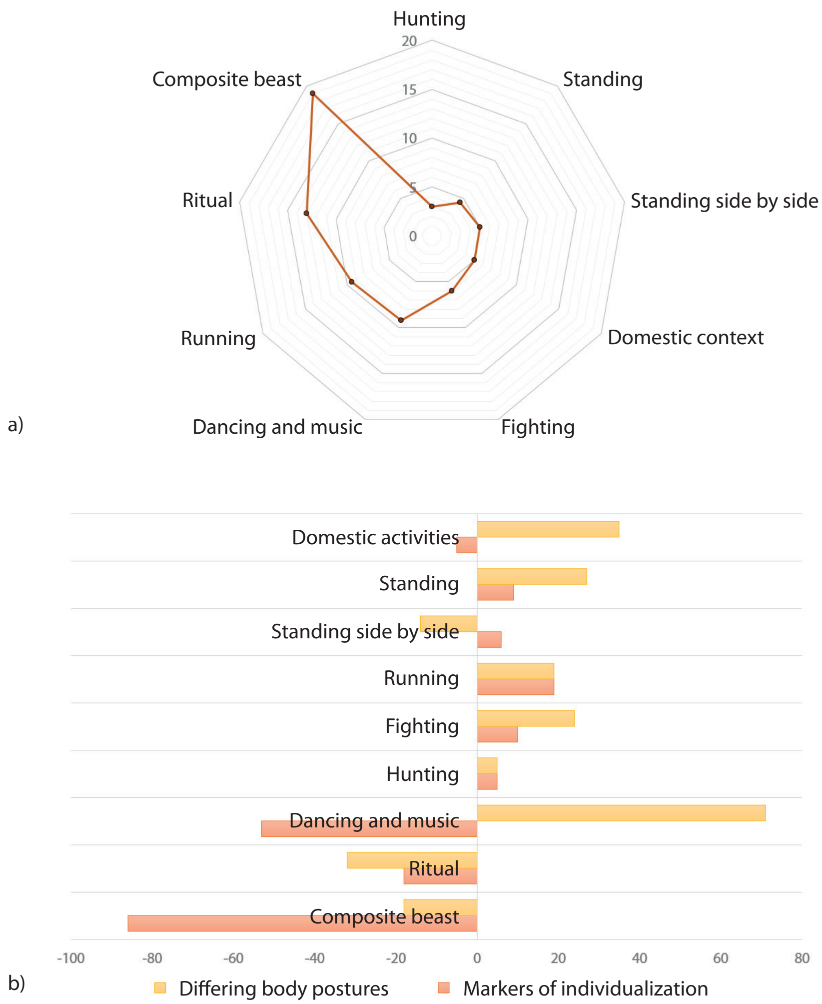

Figure 17.4. *Graphs of the average number of individuals per scene (A) and of the score of individualization (B) according to the activity depicted.*

importance of group membership in such activities would explain why individuals are being depicted as 'all equals' in these specific performances. Dancing and playing music diverge from the general correlation between individualization markers and body postures, showing a striking difference between the two. In dance, individuals are all similar and yet, by contrast, all in different positions, which is easily justified by the very nature of dancing.

Understanding social and symbolic life: transitions from hunter-gatherers to pastoralist groups

The rock art of the last hunter-gatherers differs unequivocally from pastoralist rock art in the region. There is no pastoralist equivalent to Wadi Sūra I or Wadi Sūra II found so far. The rock art surveys conducted in the Gilf el-Kebir show that pastoralist groups did paint a larger number of sites that are more widely dispersed, but all of them are, by contrast, very small. What can be said about this apparent contrast between a very small number of big sites for hunter-gatherers and a very big number of small sites for pastoralists? How do we interpret this apparent change in the way paintings were done? A direct interpretation in terms of social organization could be that pastoralists were more numerous, but lived in smaller and more scattered groups. It could also be that, for the pastoralists, the act of painting would have been practiced by family units in the context of everyday life whereas for hunter-gatherers the practice would have been more 'codified' and done only in specific contexts at defined sites. In other words, not every surface could be considered as suitable for rock art expressions by the hunter-gatherer groups, explaining why there is such a high number of superimpositions. This idea would be in line with the notion of the transmission of technical gestures formulated for European Palaeolithic art by André Leroi Gourhan (1964, 1965), according to which painting required skills transmitted only to a few people, a hypothesis further developed by Emmanuel Guy who argues for the existence of a 'noblesse Paléolithique' (Guy this volume; 2017: 115–41, 292).

Yet, the significance of the above-mentioned contrasts might be even more complex as these are not the only differences that can be observed in rock art expressions. The average number of human figures per painting unit (containing at least one) is smaller at pastoralist sites. Additionally, the variety of activities depicted is also much less important. At pastoralist sites, most scenes show herd-keeping. The importance of the human figure seems to decrease while animal depictions (especially of cattle) increase. When fighting is shown, the purpose of fight is obviously the herd. Most – if not all – social and symbolic life seems to revolve around cattle, whereas hunter-gatherer social and symbolic life is very different. Symbolic content might be expressed in the paintings of potentially headless cattle (Honoré 2012). The archaeology of the Holocene Sahara provides a picture which is consistent with these observations, with many examples of the development of a cattle cult with the onset of pastoralism (di Lernia 2006) and more widely of 'cattle-centred behaviour' (Sauvet et al. 2009: 327–9).

Human figures occupy an important role in the Wadi Sūra II shelter, *a fortiori* if we consider that the earlier layers of stencil hands (about 900 stencil hands according to Honoré et al. 2016) do represent a human presence, according to the aforementioned metonymical reasoning. Human interactions are extremely complex and varied in Wadi Sūra II paintings. The number of people involved in each scene varies significantly with the activity depicted. It is interesting to see that activities involving a small number of people (hunting, standing, standing side by side, domestic context, fighting) are more-or-less related to the everyday life, whereas activities involving a large number of people (dancing and music, running, ritual, composite beasts) seem to be typically connected with feasts and what we might term, from our point of view, the 'supernatural' (Fig. 17.4A). Evidence of beliefs like the ones expressed in the complex scenes involving a composite beast at Wadi Sūra I and Wadi Sūra II are not found in pastoralist rock art. In the latter, the symbolic role is instead devoted to cattle. Did a domestic cult replace the large gatherings that are depicted in hunter-gatherer rock art? Changes in the representations related to the 'supernatural' could indicate a radical difference not only in beliefs[4] and 'cultural' practices, but also in the symbolic world in general.

Conclusion

The hunter-gatherer groups who made the Wadi Sūra II rock paintings adopted a differential expression of equality or inequality between individuals in group scenes. The correlation between the type of activity and the degree of individualization seems to show that the expression of equality depends on the social agenda more directly than on the size of the group. Individuality is expressed more often in daily activities and in those related to subsistence, where specific roles are given to specific persons. Activities like dancing, playing music, running and cultural/mythological scenes are depicted with the least degree of individual

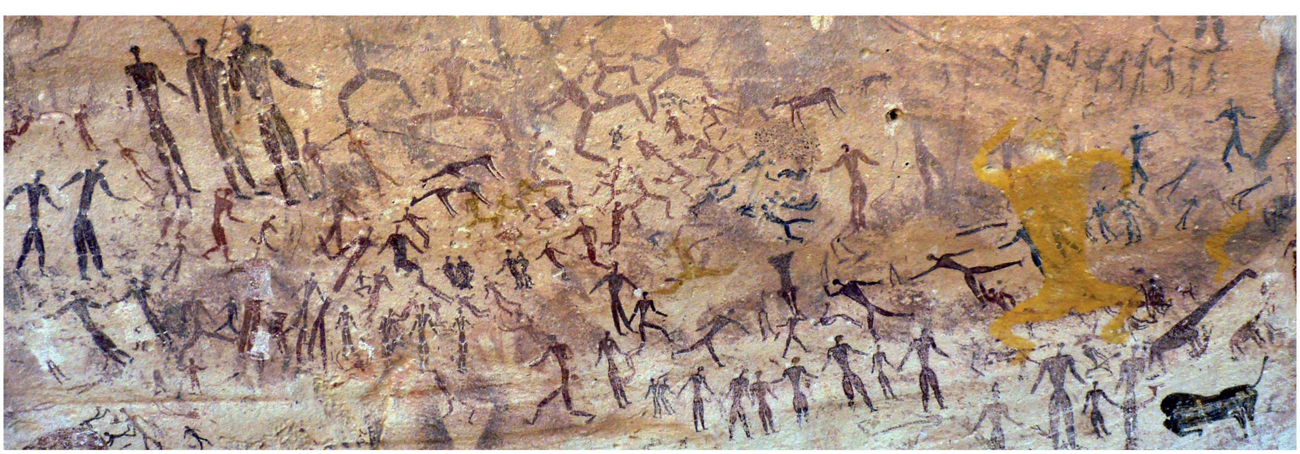

Figure 17.5. *View of rock art depictions on the right of Wadi Sūra II walls showing the dominance of human figures in the repertoire. Colour balance has been modified for the purpose of visibility.*

differentiation. In contrast to the former set of scenes, the sameness of individuals involved stands out in the latter. The social function of such activities might have been to contribute to cohesion and to the feeling of group membership. Thus, it can be said that the hunter-gatherer groups of Wadi Sūra II did depict the existence of inequalities and that they showed their social dimension through the differential expression of inequalities according to different social contexts. However, the existence and depiction of hierarchy cannot be deduced from this. Anthropologists have demonstrated that social inequality does not equate hierarchy, and *vice versa*.

Another striking pattern lies in the difference between the small number of large sites attributed to hunter-gatherers and the large number of small sites attributed to pastoralist groups in the Gilf el-Kebir. Does this reflect a demographic change, a change in the social organization of groups, or a change in the practice of rock painting? Were 'artistic' skills more widely shared at the time of pastoralism? Were figurative representations done in other contexts and/or for other purposes? The repertoire of the rock art also radically changes. Large human groupings of the hunter-gatherer repertoire tend to disappear, as well as 'ritual' and mythological scenes, while cattle is the new motif dominating most of the scenes depicted. In this regard, rock art might express a decisive change in the concept of social life by the late prehistoric groups, a change which is clearly concomitant with the adoption of pastoralism. So far, it is not possible to determine whether this change is explained by the colonization of the region by new groups with completely different social organization, or by the new organization of tasks and different worldviews that accompany farming, but these explanations are not mutually exclusive.

Beyond the understanding of some of the social dynamics in the Holocene northeastern Sahara, this case study highlights the current need to profoundly reconsider the dualistic model of egalitarian societies *versus* inegalitarian societies, since the set of ideas conveyed by it eludes a great part of the actual complexity of many forms of social organization. This binary opposition still in place in classification systems used in archaeology is not only an overly simple analytical framework, but it also implies that societies are monolithic systems and does not take into account the fact that social organizations also evolve according to the social agenda of the group. This has been described by E. Evans-Pritchard as the 'relativity of the structure', meaning that '[the] position [of an individual] in a system is relative to the functioning of the system in changing situations' (Evans-Pritchard 1940: 266). The malleable nature of social organizations explains the apparent contradictions within a unique group: according to the activities performed or the moment of life of a group, the relations between individuals and the relation to these relations vary. Rather than characterizing pre-farming societies as inegalitarian as soon as signs of inequality can be detected, we should investigate the different expressions of inequality, their context and their significance, as this paper has attempted to do, bearing in mind that different kinds of archaeological evidence can also be in contradiction.

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Notes

1. Roland Keller has mentioned the finding of a grave in the Gilf el-Kebir, but the information previously published on his personal website is inaccessible at the date of this publication and consequently unverified by the author of the present paper.
2. There is no depiction of pastoral activities on the Wadi Sūra II walls. One 'village scene' seems to show a mammal within the village and in close proximity to people. One could view the significance of this scene in relation to research in other regions which has shown that experimentation with 'cultural control' over wild mammals was done before 'proper domestication' (di Lernia 1998). More strikingly, the style of Wadi Sūra II rock art firmly differs from the styles of the well-identified pastoralist sites in the region. Unfortunately, as long as no direct dating is available, we rely on these types of arguments.
3. The score of individualization is calculated as the sum of presence (+1) or absence (-1) of differing body postures or individualization markers weighted by the number of individuals per scene.
4. In the literature, a surviving belief in such a composite beast has been hypothesized, with the goddess Ammut

being a sudden and much later resurgence in the Nile Valley during the New Kingdom (Le Quellec et al. 2005: 72), in spite of the lack of any evidence linking the two.

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Chapter 18

Social complexity, inequality and war before farming: congruence of comparative forager and archaeological data

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This chapter examines the origins of warfare as a correlate with social inequality and other features of social complexity. It addresses two interrelated questions. How old is war? And what are the drivers of the origins of war? The chapter draws upon both comparative forager and archaeological data to explore these questions.

Allen (2014; see also Gat 2015) frames the 'how old is war?' question in terms of oppositional long chronology and short chronology perspectives, where the former goes back hundreds of thousands, if not millions, of years and the latter is conceptualized as within the Holocene. Long chronologists tend to make three arguments for war being very ancient. The first is to infer a behavioural homology for the intergroup raiding of chimpanzees and humans that stretches back to a common ancestor that lived some five million years ago, a position argued by Wrangham (1999; Wrangham & Peterson 1996; Wrangham & Glowacki 2012) and endorsed by others such as Jones and Allen (2014). A second long chronology argument points to archaeologically recent warfare and ethnographically documented warring to assert that humans in a state of nature are inclined to make war (see Bowles 2009; Jones & Allen 2014; Pinker 2011; Wrangham & Glowacki 2012). The third long chronology argument holds that because traces of war in the very deep past are hard to find, the *absence of evidence does not mean the evidence of absence* (Alexander 1979; for discussion see Ferguson 1997, 2013a, b). This paper considers why neither comparative forager nor archaeological data support the long chronology view.

Until a couple of millennia before the agricultural revolution began about 10,000 years ago, humankind practiced a mobile forager lifeway (Bicchieri 1972; Henry 1985; Fry 2006, 2013; Lee & Daly 1999; Marlowe 2010). There is widespread agreement that mobile forager band social organization is largely egalitarian (e.g., Bicchieri 1972; Kelly 1995, 2013a; Lee & Daly 1999; Reyna 1994). Two paths toward social inequality entail the advent of farming and the development of complexity among foragers. Appearing within the last 12,000 years in most cases, complex foragers began to settle and undergo transitions away from a nomadic foraging way of life (Fitzhugh 2003a, b; Knauft 1991; Maschner 1997; Maschner & Reedy-Maschner 1998; Price & Brown 1985; Swanton 1946). One feature of complexification is the loss of egalitarianism. On the basis of data from a large sample of foragers, Binford (2001) concludes that foragers remain mobile until population growth initiates settling down, usually in resource-rich aquatic environments, and the more intensive use of resources.

Fry (2006) found that all of the complex, non-egalitarian societies in an ethnographic sample of foragers engaged in war, whereas a majority of the mobile foragers in the sample did not. This finding suggests that changes associated with the development of social complexity – such as settling down, development of social inequalities, population increase, rise of ambitious leaders, accumulation of stored food and other items to plunder – greatly increase the likelihood of warfare over that encountered in mobile forager social organization.

Taking a long chronology view, Bowles (2009) and Pinker (2011) have asserted that mobile foragers from the Pleistocene were subject to high rates of war mortality, proposing that war deaths averaged about 14 per cent. Projecting warfare into the deep past on the basis of self-selecting ethnographic cases and archaeological examples represents a questionable methodology for a variety of reasons. First, there is the problem of sampling bias. Second, ethnohistory and ethnography document time-and-again that colonialism and then national policies impact foragers in various parts of the globe, displacing them from their land, constricting their habitats, reducing the game upon which they depend, fomenting conflict within and among neighbouring societies, making available alcohol and guns, practicing genocide against them, and so forth (Bodley 1999; Ferguson & Whitehead 1992; Fry 2006, 2013; Fry & Söderberg 2014; Guenther 2014; Headland 1989; Hill & Hurtado 1996; Hill, Hurtado & Walker 2007; Lee 2014). Third, conflicts in mobile forager social organization tend to be interpersonal stemming from sexual jealousy, insults, and revenge for a misdeed rather than intergroup grievances (Griffin 2000; Headland 1989; Hill et al. 2007; Fry 2006; Fry & Söderberg 2013a, b, 2014; Service 1966).

Fry & Söderberg (2013a, b) found low levels of group-to-group lethal aggression in mobile foragers and that a majority of lethal events involved only one person killing only one other person. At the minimum, 36 per cent of all lethal events took place within local bands between husband and wife, other relatives, neighbours, and had nothing to do with intergroup hostilities. Five cases of obvious war involved the mobile Hadza foragers of East Africa attacking and being attacked by cattle-herding neighbours. These group-to-group lethal exchanges involving the Hadza show that, although unusual, nomadic foragers are capable of inter-societal group-to-group fighting (Guenther 2014). However, this violent conflict scenario of foragers versus herders cannot logically be projected back into the deep evolutionary past since cattle-herding is a relatively recent development.

The pattern of disputes being individual rather than corporate in nomadic forager societies raises the question as to whether some cases referred to as 'war' in the mobile forager literature are in reality interpersonal disputes. There are examples that show the 'war' label has been misapplied to individual conflicts in the mobile forager context (Fry 2006; Fry & Söderberg 2014). For example, the term 'a declaration of war' was used to describe how an Alacaluf man, aided by his brother, placed objects around his adversary's hut as a warning that he was going to try to kill him for eloping with his wife: 'The husband tried to get her back by force, but was beaten off by his competitor. …The two brothers subsequently ambushed the rival and killed him with a spear' (Bird 1946: 71).

To address questions about the antiquity and origins of war, this chapter will draw upon archaeological and ethnographic data across the foraging spectrum, from egalitarian to ranked societies. We will suggest that a short chronology view not only has the weight of the archaeological and comparative forager data behind it, but also springs from a corpus of knowledge on the relationship of war and sociopolitical complexity (see for example Ferguson 1990, 1997, 2013a, b; Fitzhugh 2003a, 2003b; Flannery & Marcus 2012; Fry 2006; Johnson & Earle 1987; Kelly 2000; Malinowski 1941; Reyna 1994). The chapter also will offer some philosophy of science reflections as to why the long chronology view of war continues to be asserted despite a paucity of theory and evidence in its favour.

Archaeology provides examples of how complexity developed over time and ethnography shows the variations among societies in the forager spectrum. Consequently, in agreement with Fitzhugh (2003a), complexity is better conceptualized as scalar or as a continuum of increasing features rather than as a threshold that is crossed. Complexity also is multifactorial. In the quest to understand the origins of war, isolating causal factors becomes critical. What are the demographic, subsistence-ecological, and sociopolitical conditions that drive the origin of war? Fitzhugh (2003a: 23) not only provides a listing of elements thought to be important in the complexification process but also presents a model that orders key features into a chronological sequence.

These include 1) colonization and expansion, 2) reduced foraging ranges and territoriality, 3) technological changes to overcome seasonal variation, increased population density and village aggregation, 4) increased structuring of residential populations into corporate groups, localized competition, emergence of inequality and ranking, 5) expansion of political alliances, trade, and warfare, and the emergence of a system of symbolic value capable of discriminating individuals on the basis of their access to resources, labour, and networks of power.

Population growth has been noted to precede the origin of war in places such as the Northwest Coast of North America (Maschner 1997), Kodiak Island (Fitzhugh 2003a, b), and eastern North America (Dye 2009, 2013). Darwent & Darwent (2014) point out that the warring Inuit populations of Northwest Alaska had a much higher population density than the non-warring Inuit groups to the east in Canada and Greenland (Darwent & Darwent 2014). Similarly, Roscoe (2014) notes an association between raiding and population density for New Guinea. Robert Kelly (2013a, b) argues that since net above ground productivity (NAGP) varies across ecosystems, population pressure defined as productivity divided by population density is a better measure than population density *per se*, and he reports a correlation of population pressure with conflict for a sample of foragers.

Another factor that may contribute to the origin of war is degree of mobility. Binford (2001) concludes on the basis of his comparative study that mobile foragers move in response to conflict but once groups become packed with no place to move, they compete. Kelly (2013a: 205) reaches a similar conclusion that foragers settle down 'because population density is so high relative to habitable places on the landscape that residential movement is not possible without displacing another group. War appears when mobility is not an option.' And Haas (1999: 13) concurs when he says, 'warfare tends to go hand in hand with increasing political complexity and rising levels of population density.'

Turning to sociopolitical variables, Raymond Kelly (2000) suggests that another contributor to warfare, or at least feuding, is when a society develops social segments. Dye (2013: 146) concurs and comments on the pattern in eastern North America: 'As population increases, reliable storage facilities and surplus come into being, bringing about the emergence of segmentary organization and the increased likelihood of feuding.' Reyna (1994) points out that once hierarchical chiefdoms arise, leaders develop the capacity to order others to fight on their behalf. And Fitzhugh (2003a) proposes that political competition among leaders, not population pressure per se, drives warfare.

In sum, the anthropological literature presents various hypothesized contributors to the origins of war, some of which may synergistically interact with one another, such as population growth, intensification of resource use, sedentism, development of social segments, food storage, leader prerogative and rivalries, social inequality, and quest for wealth accumulation, and so on. Ferguson (2013b: 192) lists preconditions of war:

> *Geographic concentration of critical resources, sedentism, high population density, food storage and/or livestock, social divisions creating separate collective identities, social and political hierarchy or ranking, monopolizable long-distance trade in valuable prestige goods, and major ecological reversals affecting food production.*

On the other hand, Allen, Bettinger, Codding, Jones & Schwitalla (2016: 12, 120) question whether 'violence should be more common among groups with greater sociopolitical complexity, with leaders able to enforce participation through sanctioned punishment.' Based on an analysis of a large database from California on nearly 17,000 prehistoric burials, Allen et al. (2016: 12, 122) conclude that 'violence has little or nothing to do with sociopolitical complexity.' Whereas the complexity hypothesis stems from the literature about the origins of warfare, Allen et al. (2016: 12, 121) acknowledge that they have not distinguished between 'interpersonal vs. coalitional lethal aggression, or intra- vs. intergroup violence.'

Research questions

The foregoing introduction leads to several topics that will be investigated here. First, do the features regularly noted to occur during complexification, whether called precursors, drivers, or causes of war, correlate with one another? Should the focus be on population density or population pressure? Does the reliance on aquatic resources correlate with the development of complexity, as Binford (2001) proposes?

Second, does warfare correlate with increased complexity? Anthropologists have long seen war and social complexity going hand-in-hand (e.g., see Hobhouse, Wheeler & Ginsberg 1915; Malinowski 1941; Reyna 1994; Kelly 2000), although a recent archaeological study challenges this association (Allen et al. 2016). Do other forms of lethal aggression (e.g., homicide) correlate with increased complexity?

Third, how does a combined consideration of both comparative forager and archaeological data enhance our understanding of war, violence, and complexity? What do the data suggest about the soundness of adopting long versus short chronologies for the origins of war? How can we move beyond such dichotomized views?

This chapter will present a quantitative analysis of lethal aggression across the forager complexity spectrum using a systematically derived ethnographic sample. In the discussion section, data from archaeology on population, war, and complexity will be integrated with comparative forager findings. The chapter concludes with some broader reflections on the scientific study of the origins of war.

Methods

Sample

A widely used ethnographic sample of 186 societies compiled by Murdock & White (1969), called the Standard Cross-Cultural Sample (SCCS), takes into consideration the lack of independence among ethnographic cases within the same culture area (Galton's problem). The resulting sample represents worldwide cultural provinces including forager societies from around the world.[1] Separately, Murdock (1967, 1981) compiled an *Ethnographic Atlas*, which contains codes for key cultural features for numerous societies.

Murdock's cultural codes related to subsistence economy (column 7) can be used to separate the non-foragers from the foragers in the SCCS. Foragers are operationally defined in this study as non-equestrian societies having no more than five per cent subsistence dependence on agriculture and animal husbandry (Fry 2006; Fry & Söderberg 2013a, b). Thirty societies in the SCCS meet this stringent operational definition of foragers and represent forager societies from all habitable continents except Europe (Table 18.1).

Procedure

Each society in the forager sample has ethnographic sources ranked by White (1989) as *principal authority sources*, meaning that they are primary good quality sources related to particular times and locations. The principal authority sources represent 'the best-described societies in each of 186 world cultural provinces' and 'the earliest date of high-quality description for each' (White 1989: 1). A bibliography of principal authority sources lists the relevant ethnographic literature for each society used in this study (White 1989).

The methodology used by Fry & Söderberg (2013a, b) to investigate lethal aggression among mobile forager band societies (n = 21) was employed in this study to expand the sample to include non-mobile forager societies (n = 9) in the SCCS. All specific cases of lethal aggression were extracted from the principal

Table 18.1. *The forager societies represented in the Standard Cross-Cultural Sample, excluding equestrian hunters.*

Society	Continent	Population density	Class distinctions	Settlement
Mobile egalitarian sub-sample				
Kung	Africa	6.60	No	B
Hadza	Africa	24.00	No	B
Mbuti	Africa	44.00	No	B
Semang	Asia	17.57	No	B
Andamanese	Asia	33.38	No	S
Vedda	Asia	18.50	No	S
Tiwi	Australia	37.50	No	B
Aranda	Australia	2.66	No	B
Copper Eskimo	North America	.43	No	S
Northern Salteaux	North America	1.20	No	S
Slave	North America	1.00	No	S
Paiute (Harner Valley)	North America	1.24	No	S
Ingalik	North America	2.71	No	S
Naskapi	North America	.41	No	B
Micmac	North America	4.32	No	S
Kaska	North America	.90	No	S
Bodocuda	South America	9.80	No	B
Aweikoma	South America	4.10	No	B
Yahgan	South America	28.42	No	B
Gilyak	Asia	19.31	No	S
Yukaghir	Asia	.61	No	S
Settled non-egalitarian sub-sample				
Aleut	North America	54.65	No	V
Eyak	North America	5.86	Yes, wealth-based	V
Haida	North America	97.09	Yes, hereditary	V
Bella Coola	North America	13.00	Yes, hereditary	V
Twana	North America	32.40	Yes, wealth-based	T
Yurok	North America	131.00	Yes, wealth-based	V
Eastern Pomo	North America	127.00	Yes, wealth-based	T
Lake Yokuts	North America	38.10	Yes, wealth-based	S
Klamath	North America	13.36	Yes, wealth-based	S

Note: The society names/spellings are retained from the SCCS. Population densities are from Binford (2001). *Class* presence/absence ratings are from Murdock (1967, column 67) and *Settlement* ratings are from Murdock (1967, column 30, see also Murdock 1981: 99), where B = fully nomadic band, S = semi-nomadic, T = semi-sedentary settlements, and V = fairly permanent villages and towns.

authority ethnographic material. Data on the specifics of each event were recorded, e.g., sex of killer(s), sex of victim(s), number of perpetrators, number of fatalities, reasons for the lethal encounter, relationship between perpetrator(s) and victims(s), and so forth. Fry and Söderberg (2013a, b) did not classify on an *a priori* basis lethal events as manslaughter, homicide, feud, or war, and the current study followed the same methodological procedures related to the nine additional forager societies in the SCCS.

After an initial collection of events involving lethal aggression, several types of cases were excluded from the analysis. Excluded cases consisted of duplicate mentions of the same event, cases mentioned in principal authority sources that did not actually involve any members of the sample society, and cases that involved only supernatural means of killing (e.g., sorcery). Aside from such exceptions, all lethal events reported in the literature were included in the analysis.

Additionally, data on a variety of demographic, subsistence, and social features were added to the database for the 30 forager societies listed in Table 18.1 from published codes and values by Binford (2001) and Murdock (1967). From Binford (2001), data on population density (DENSITY), population pressure (NAGP/DENSITY) percentage of aquatic resources in the diet (FISHING), ranking (SYSTATE3), political development (POLYSCAL), class structure (CLASS), leadership (PEROGAT), maximal local group size (GROUP2), size of regional aggregations of local groups (GROUP3), and number of residential moves per year (NOMOV) were included (Binford's variable names appear in all caps in parentheses). From Murdock (1967; see also 1981) the database was expanded to include data on class stratification (column 67), settlement pattern (column 30), and slavery (column 71). SPSS, version 25, was used to investigate relationships among demographic, subsistence, and socio-political variables in relation to types of lethal aggression.

Results

Sub-groups of foragers compared

Means and standard deviations for the entire sample (n = 30) and for sub-samples defined by a dual consideration of settlement pattern (mobile versus sedentary) and class structure (egalitarian versus hierarchical) are presented in Table 18.2. For the whole sample of foragers, both the number of lethal aggression events per society that involved one person killing one other person, that is, homicide or manslaughter, and those that involved more-than-one perpetrator killing more-than-one other victim, that is, possible acts of war, averaged to about three such events per society. The situation in which more-than-one killer dispatched a single victim occurred less often. The scenario wherein one person killed more-than-one person was comparatively rare (Table 18.2).

Following Fry (2006), when the sample is subdivided based on settlement and class structure to operationally distinguish *mobile egalitarian foragers* from *settled non-egalitarian foragers*, some significant differences emerge. Mobile egalitarian foragers change residence in the course of a year significantly more often than complex foragers (Mann-Whitney U test, $p < .001$), average about one-fourth the population density as complex foragers (Mann-Whitney U test, $p = .003$), and face less population pressure than their complex forager counterparts (Mann Whitney U test, $p < .001$), as reflected in a substantially higher value for this variable, meaning that more food is available per person than in complex forager societies. Settled, non-egalitarian complex foragers also where significantly more reliant upon fishing than their mobile egalitarian counterparts (Mann-Whitney U test, $p = .003$). No significant difference was found for either band/village group size or maximum group aggregation size for the two sub-samples.

In terms of types of lethal aggression, the only significant difference between mobile and complex foragers involved events wherein more-than-one perpetrator took the life of more-than-one victim, a category of group aggression that could constitute war. This type of group-on-group lethal violence was significantly higher among the complex forager sub-group (Mann-Whitney U test, $p = .012$). Although not significant, it is worth noting the average for one-on-one lethal aggression for settled non-egalitarian foragers was half the average for mobile egalitarian foragers, or in other words, a non-significant trend in the opposite direction as the significant difference for group-on-group lethal aggression.

A complexity complex

Table 18.3 shows correlations for the entire forager sample for various demographic and social features. Population density is positively correlated with sedentism, hierarchical class structure, and social ranking and negatively correlated with the number of residential moves per year, maximal size of temporary aggregations of local groups, and population pressure (where the higher the value for the population pressure variable conversely reflects lower population pressure). Sedentary residence correlated positively with a variety of attributes that reflect hierarchical social structure such as social class, social ranking, prerogatives of leaders, authoritativeness of leadership, and slavery (Table 18.3). The percentage of food that fishing

Table 18.2. *Means and standard deviations for the whole sample and sub-samples defined by settlement and class.*

	Whole sample (n = 30)		Mobile egalitarian (n = 21)		Settled non-egalitarian (n = 9)	
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Population density	25.7	35.1	12.3	13.9	56.9	49.3
Population pressure	145.1	202.8	196.4	223.6	25.3	32.5
Settlement	2.1	1.0	1.5	.5	3.3	.9
Settlement (dichotomized)	1.2	.4	1.0	0.0	1.8	.4
Group size (band/village)	76.6	107.0	55.9	36.1	125.7	187.8
Number of moves/year	9.2	8.5	12.3	8.4	2.0	2.0
Group size (aggregation)	110.4	100.1	128.5	101.3	68.0	88.3
Social class (B)	1.5	.7	1.1	.3	2.3	.5
Social class (M)	1.3	.6	1.0	0.0	2.1	.6
Ranking	5.1	1.1	4.6	.7	6.3	.5
Leadership	1.9	1.2	1.4	.7	3.1	1.3
Political development	2.1	1.0	1.8	.7	2.9	1.1
Slavery	1.4	.7	1.1	.2	2.2	.8
Reliance on fishing	38.8	31.0	27.4	26.2	65.3	25.4
Lethal aggression, 1 to 1	2.9	5.3	3.5	6.2	1.4	1.6
Lethal aggression, >1 to 1	1.7	3.9	1.5	4.3	2.2	2.9
Lethal aggression, >1 to >1	3.3	6.7	1.4	3.5	7.8	10.1
Lethal aggression, 1 to >1	.1	.3	.05	.2	.2	.4
Lethal aggression, total	8.6	14.1	7.0	14.6	12.1	12.7

Sources: Data are derived from Binford (2001) and Murdock (1967).
Description of the variables: 1. *Population Density* is in persons per 100 sq. km (Binford 2001, variable DENSITY). *Population Pressure* is calculated by dividing *Net Above Ground Productivity* by *Population Density*; data for both variables are from Binford (2001, variables NAGP/DENSITY). Note that the higher the value for this *Population Pressure* variable means that there is more food per capita, and hence relatively *higher* values conversely mean that there is *lower* population pressure. *Settlement* has four values, 1 to 4, on an ordinal scale of increasing sedentism, where 1 = nomadic bands, 2 = seminomadic with mobility for at the minimum of at least half of the year, 3 = transhumance with the switching between either fixed settlements or between a fixed settlement and seasonal camps, and 4 = permanent towns and villages (Murdock 1967: settlement codes, column 30). *Settlement (dichotomized)* converts *Settlement* codes 1 and 2 and separately codes 3 and 4 into two new values (mobile versus settled). *Group size* is the maximum size of the local group, whether a band or a settled village/town (Binford 2001, variable GROUP2; missing cases reduced the n to 27 for this variable). *Number of Moves/Year* is the number of times that a local group moves in a year's time (Binford 2001, variable NOMOV). *Group Size (aggregation)* is the maximum size of temporary aggregations of smaller units (Binford 2001, variable GROUP3). *Social Class (B)* has three values, 1 to 3, on an ordinal scale of increasing hierarchy, where 1 = absence of any significant class distinctions, 2 = wealth distinctions only, and 3 = dual stratification into inherited nobles and ordinary people (Binford 2001: variable CLASS). *Social Class (M)* has three values, 1 to 3, on an ordinal scale of increasing hierarchy, where 1 = 'absence of significant class distinctions among freemen…ignoring variations in individual repute achieved through skill, valor, piety, or wisdom,' 2 = 'wealth distinctions, based on the possession or distribution of property, present and socially important but not crystallized into distinct and hereditary social classes,' and 3 = 'dual stratification into a hereditary aristocracy and a lower class of ordinary commoners or freemen, where traditionally ascribed noble status is at least as decisive as control over scarce resources,' (Murdock 1967: class stratification codes, column 67; see Murdock 1981: 101–2). *Ranking* is an ordinal scale of social hierarchy with four values, 4 to 7, where 4 = generic (mobile) foragers, 5 = generic (mobile) foragers with instituted leadership, 6 = wealth-differentiated foragers, and 7 = internally ranked foragers, and is based on Binford's (2001) composite social system variable called SYSTATE3 (n = 28 for *Ranking* since three cases with a value of 3 were removed for analysis). *Leadership* has four relevant values, 1 to 4, on an ordinal scale of increasing authoritative leadership, where 1 = leaders have no special prerogatives, 2 = leaders are not free of subsistence tasks but have assistants, 3 = leaders are not free of subsistence tasks, have minimal specialized emblems, but may have messengers and speakers, and 4 = leaders do have relief from subsistence activities, have various types of assistants, and leader's wives have status also (Binford 2001: 338, variable PEROGAT). *Political Development* has four values, 1 to 4, on an ordinal scale on the importance of leaders, where 1 = autonomous local groups have only advisory, informal leadership, 2 = autonomous local groups have performance-based leadership, 3 = autonomous local groups have advisors convened by a leader who has corporate duties, and 4 = local groups are subordinate to overarching leadership (Binford 2001: 252, 338, variable POLYSCAL). *Slavery* has three values, 1 to 3, on an ordinal scale of increasing degree of socially sanctioned servitude, where 1 = absence of slavery, 2 = incipient slavery, and 3 = hereditary slavery (Murdock 1967: slavery codes, column 71). *Reliance on Fishing* is the percentage of reliance on aquatic resources in the diet (Binford 2001: variable FISHING). *Lethal Aggression 1 to 1* involves one person killing one person; *Lethal Aggression >1 to 1* involves more than one person killing one person; *Lethal Aggression >1 to >1* involves more than one person killing more than one person; and *Lethal Aggression 1 to >1* involves one person killing more than one person (Fry & Söderberg 2013a, b). *Lethal Aggression, Total* is a summation of all lethal aggression instances.

contributed to the diet also correlated positively with settled residence, local group size, social class, social ranking, leadership, and slavery.

Social organization and types of lethal aggression

Table 18.4 presents correlation coefficients for the four types of lethal aggression and a variety of demographic and social variables. The one-on-one type of lethal violence (homicide and manslaughter) does not correlate with any of the variables. Likewise, there are no significant correlations for the demographic and social variables with either more-than-one killer assaulting a single victim or for a single killer attacking more-than-one victim. However, the type of group-to-group lethal aggression wherein more-than-one perpetrator killed more-than-one victim shows multiple significant correlations. This group-on-group type of lethality correlated positively with population density, sedentism, size of local groups, two measures of social class, and slavery and correlated negatively with the maximum size of aggregations of local groups.

Discussion

Political complexity and war

The discussion will focus on three main areas that consider the comparative forager findings and loop-in what is known from archaeology. One clear conclusion from the comparative forager findings reported here is that there is a *complexity complex* wherein a host of variables (e.g., population density, population pressure, settlement, social class, slavery) correlate with each other. Given the relatively small sample size and the consequent reduction in statistical power, the large number of correlations that reached significance is noteworthy.

The finding that reliance on aquatic resources also is part of the complexity complex corresponds with ethnographic and archaeological knowledge on complex foragers from such cases as Northwest Alaska, Kodiak Island, the Northwest Coast of North America, New Guinea, and the Calusa of Florida (Binford 2001; Roscoe 2006). The reliance on aquatic resources is consistent with Binford's (2001) interpretation that fishing and related resources make the development of complexity possible. It is interesting that two early sites showing evidence of violent conflict, Nataruk on the ancient shores of Lake Turkana, dated to about 10,000 BP, and Jebel Sahaba near the banks of then marshy inlets on the Nile River, dated at 11,600 BP, may have exhibited semi-settled, larger populations due to the abundant aquatic resources than were typical at these times (Haas & Piscitelli 2013; Lahr et al. 2016a). In the Nataruk case, the presence of pottery suggests food storage. According to Robert Foley (quoted in Ghose 2016), 'hunter-gatherers who tend to stay in one place for longer periods often live near lakes, where food is plentiful and unlikely to be depleted by

Table 18.3. *Correlations among demographic and social features.*

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Population density	-.623***	.185	.412**	.029	-.414**	-.338*	.411***	.364*	.324*	.119	.209	.221	.047
2. Population pressure		-.296*	-.435**	-.063	-.480***	.148	-.525***	-.462**	-.305*	-.068	-.182	-.339*	-.235
3. Settlement			.731***	.270	-.526***	-.269	.721***	.631***	.641***	.482**	.451**	.645***	.551***
4. Settlement (dichotomized)				.263	-.536***	-.304	.749***	.736***	.650***	.571***	.410*	.751***	.468**
5. Group size (band/village)					-.145	-.057	.225	.263	.362*	.297	.389*	.227	.299*
6. Number of moves/year						.392**	-.646***	-.545***	-.504***	-.314*	-.342*	-.421**	-.340*
7. Group size (aggregation)							-.299	-.196	-.288	-.138	-.201	-.340*	-.152
8. Social class (B)								.774***	.877***	.579***	.612***	.695***	.540***
9. Social class (M)									.668***	.467**	.383*	.663***	.372*
10. Ranking										.738***	.704***	.669***	.523***
11. Leadership											.647***	.347*	.326*
12. Political development												.363*	.370*
13. Slavery													.538***
14. Reliance on fishing													

*** = Correlation is significant at the 0.001 level (2-tailed).
** = Correlation is significant at the 0.01 level (2-tailed).
* = Correlation is significant at the 0.05 level (2-tailed).
Note: See Table 18.2 for a description of the variables and values. All correlations are based on an n = 30, except for those involving the variables *Ranking* and *Group Size* (n = 27). Since most correlations involve one or more ordinal variables, the correlation statistics reported are Kendall's Tau.

Table 18.4. *Correlations of demographic, settlement, social variables with types of lethal aggression.*

	Types of lethal aggression			
	1 to 1	>1 to 1	>1 to >1	1 to >1
Population density^P	.004	.207	.528**	-.079
Population pressure^P	-.023	-.138	-.224	-.127
Settlement	-.119	-.010	.195	.199
Settlement (dichotomized)	-.230	-.023	.441**	.079
Group size (band/village)^P	.022	-.042	.726***	-.111
Number of moves/year^P	.016	-.060	-.251	-.102
Group size (aggregation)^P	-.187	-.202	-.395*	-.027
Social class (B)	-.205	.118	.374*	.153
Social class (M)	-.043	.234	.420*	.259
Ranking	-.239	.078	.291	.066
Leadership	-.176	-.066	.176	-.026
Political development	-.210	-.042	.111	-.019
Slavery	-.145	-.025	.403*	.225
Reliance on fishing^P	.041	.065	.332	.104

*** = Correlation is significant at the 0.001 level (2-tailed).
** = Correlation is significant at the 0.01 level (2-tailed).
* = Correlation is significant at the 0.05 level (2-tailed).
Note: See Table 18.2 for a description of the variables and values. Kendall's Tau correlations are reported when ordinal variables are involved; Pearson correlations (^P) are reported for interval variables.

long stays. …That fits into the idea of a slightly more densely packed population where intergroup conflict is likely to arise.'

Haas & Piscitelli (2013: 181) point out that Jebel Sahaba 'is clearly not anything like a typical, nomadic hunting and gathering site characteristic of the Upper Palaeolithic in other parts of the world. …The presence of an actual graveyard with 58 excavated burials indicates intensive and long-term use.' They next quote the excavator of the ancient cemetery, Fred Wendorf (1968 quoted in Haas & Piscitelli 2013: 181):

> *Population pressures may have become too great with the deterioration of the Late Pleistocene climate and the effects which this had on the herds of large savanna-type animals which were the primary source of food at this time. With this situation, the few localities which were particularly favorable for fishing would have been repeatedly fought over as other sources of food became increasingly scarce.*

Turning to the relationship between types of lethal aggression and the complexity features, only lethal aggression committed by more-than-one person toward more-than-one victim positively correlates with complexity variables (specifically, population density, settlement, local group size, social class, and slavery). Whereas not all cases of group-on-group lethal violence could be considered war (for example if the lethal event took place within the same band/village), many instances did take place between members of different communities or societies, and could be considered war, defined here as 'relatively impersonal lethal aggression between communities' (Fry 2006: 91).

Interestingly, none of the other three types of lethal aggression correlate with social complexity variables. This suggests that complexification does not necessarily go along with an increase in one-on-one killings (e.g., homicide or manslaughter). As a caution, it is important to keep in mind that the sample size is relatively small (n = 30). It will be interesting to see if this finding holds up in future studies. It might be that the presence of war can contribute to a lower rate of intra-societal killings as socialization and social pressures are exerted against such deeds in the light of external threats (e.g., see Roscoe 2014; Wallace & Hoebel 1952). Regarding events wherein one person kills more-than-one victim, the relative rarity of such instances may reflect the risks of attacking more than one adversary at the same time. This risk minimization interpretation is consistent with the observation that at least in some cases, the multiple victims were relatively harmless children killed by an adult (Fry & Szala 2013; Wrangham 1999).

The current finding that socio-political complexity correlates significantly with lethal incidences of more-than-one killer engaging more-than-one victim contradicts the conclusion reached by Allen et al. (2016) that there is no relationship between socio-political complexity and lethal aggression, based on their study of skeletal trauma in burials representing 19 prehistoric Californian societies in the late Holocene. There are at least two possible reasons why Allen et al. (2016) did not find a relationship between complexity and lethal aggression. First, their sample is highly homogeneous regarding complexity, which minimized the chance of statistically demonstrating a true association between variables. These Californian societies tended to show some but not maximal features of sociopolitical complexity, having for instance class distinctions based on wealth. For one measure of complexity involving leadership, 16 out of 19 societies had the same value; for their other complexity variable dealing with political organization, 15 out of 19 cases had the identical value. Hence, these two complexity variables are highly homogeneous and, coupled with a relatively small sample, a distribution of this nature poses an obstacle to discovering an existing relationship between complexity and violence. By contrast, the current worldwide sample of foragers addresses Galton's problem related to oversampling from a cultural area and reflects greater cross cultural variation in forager socio-political complexity variables than does the regionally homogeneous sample from central California.

Another possible non-mutually exclusive reason that Allen et al. (2016) find no association between complexity and lethal violence, viewed in light of the finding reported here on one-to-one killings not correlating with complexity, would be if the Californian prehistoric cases of lethal trauma proportionately reflect one-on-one killings relative to cases with more-than-one killers and victims. In other words, if one-to-one killings were heavily represented in their burial cases relative to group-on-group violence, we would not necessary expect to find an association of lethal violence with complexity. As Allen et al. (2016) acknowledge, they do not attempt to distinguish interpersonal from intergroup violence so the types of lethal violence under consideration remains uncertain.

In contrast to the dismissal of complexity by Allen et al. (2016), the findings of the current study correspond with theoretical predictions and previous empirical observations that war and socio-political complexity are in fact associated (e.g., Ferguson 2013a, b; Fitzhugh 2003a, b; Fry 2006; Hobhouse et al. 1915; Johnson & Earle 1987; Malinowski 1941; Reyna 1994) and conversely that war and mobile, egalitarian band social organization tend not to go together (e.g., Darwent & Darwent 2014; Fry & Söderberg 2013a, b; Guenther 2014; R.C. Kelly 2000; R.L. Kelly 1995, 2013a; Lee 2014; Lee & Daly 1999; Service 1966). In sum, both comparative ethnography and archaeology support a congruent overall picture of the association of warfare and social complexity.

Archaeology and the origins of war

Three types of archaeological evidence pertain directly to the timing and nature of the origins of war. The first line of evidence pertains to population changes, the second to the earliest worldwide evidence of war, and the third to regional archaeological sequences demonstrating the relatively recent origins of war from prior conditions of warlessness.

Population. In the current study, population density was strongly correlated with actual population pressure as experienced by forager societies in the sample. Both population density and population pressure correlated strongly with social class and other social inequality variables as well. Interestingly, whereas population density strongly correlated with group-on-group lethal violence, population pressure did not.

Haas & Piscitelli (2013; Haas 1996) point out that the total human population was extremely low over most of the genus *Homo*'s time on Earth. Only during the Holocene did humans undergo exponential population grow. Just prior to the Holocene (19,000 to 13,000 BP), the Late Pleistocene populations of Australia, Asia, Europe, and Africa combined have been estimated at about 500,000 people, or .3 persons per 100 sq. km (Haas & Piscitelli 2013). By way of comparison, for an extant sample of Holocene foragers from Africa, Asia, Australia, North America, and South America derived by Kelly (2013b: Table 9.1), the average population density is 34.12 persons per 100 sq. km, which amounts to 113 times the estimated population density for the world-wide forager population near the end of the Pleistocene.

In the current study, the average population densities in persons per 100 sq. km for the total forager sample, mobile sub-sample, and complex sub-sample are, respectively, 25.7, 12.3, and 56.9 (Table 18.2), in all cases many times higher than the late Pleistocene estimate of .3. Specifically, the average population density for the SCCS mobile foragers, the majority of which are non-warring, is 41 times higher than this late Pleistocene estimate.

To consider one more population density comparison, Roscoe (2014: 229) reports a population density equivalent to 80.0 persons per 100 sq. km for 10 contact-era, mostly semi-sedentary sago palm harvesting foragers from freshwater wetlands in New Guinea with relatively high rates of lethal aggression. These New Guinea foragers have an average population density 267 times that of the estimated worldwide Late Pleistocene population. An implication is that using high density New Guinea foragers to draw insights about lethal conflict in the evolutionary past is problematic. Complex fisher-foragers from New Guinea, which resemble the North American North West Coast societies in terms of war-making and sociopolitical complexity, have even higher population densities than the New Guinea semi-sedentary freshwater wetlands group (Roscoe 2014).

Even if the .3 world population density estimate for the late Pleistocene were an order of magnitude too low and thus were 3.0, an unlikely possibility, the recent Holocene forager population densities shown in Table 18.2 still average several-to-many times the late Pleistocene estimate, that is, even if divided by 3.0 instead of .3. An implication of these demographic observations is that there may have been too few people, living in small bands, spread out over huge land areas to have any reason for making war over resources. Haas (1996: 1360) proposes that 'it was only about 10,000 years ago that the niches of the world were filled in through gradual population growth, and people had to develop new settlement and subsistence strategies to extract adequate resources from decreased territory.' And Haas & Piscitelli (2013: 176; see also Keely 2000) add: 'for 190,000 years of human existence on the planet, low population densities obviated all the proposed biological or cultural reasons for warfare and intraspecific conflict.'

Aside from the consideration of worldwide population growth over the Pleistocene and into the Holocene, support for Haas & Piscitelli's (2013) inference comes, first, from the observation that extant mobile foragers, despite typically higher population densities than Pleistocene estimates and despite a variety of recent conflict-inducing factors, nonetheless tend not to engage in much warfare (Fry 2006; Fry & Söderberg 2013a, b; Guenther 2014). Fry & Söderberg (2013a, b) review nine factors that militate against warfare under mobile forager conditions, of which low population densities is only one. Second, in both the findings of the current study and in the literature, group-on-group fighting is associated with increases in population densities, as one factor in the complexity complex (Darwent & Darwent 2014; Kelly 2000; Roscoe 2014), and/or increases in population pressure (Kelly 2013a, b). Third, whereas mobile forager groups subsisting at low population densities and pressures simply move rather than attempt to displace another group, competition among foragers for territory or resources begins once the population in an area becomes packed, to use Binford's term, and resource-rich areas become worth fighting over (Binford 2001; Maschner & Reedy-Maschner 1998; Fitzhugh & Kennett 2010; Kelly 2013a).

Lack of pre-Holocene evidence of war. The assertion that war is hundreds of thousands if not millions of years old simply lacks archaeological evidence to support it. With one possible exception, the earliest evidence of warfare anywhere in the world is within the Holocene. After reviewing the archaeological evidence on prehistoric homicides and warfare, Keeley (1996: 39) reaches the conclusion 'that homicide has been practiced since the appearance of modern humankind and that warfare is documented in the archaeological record of the past 10,000 years in every well-studied region.' Homicide predates by far the evidence for war and has parallels in the low percentage of intraspecific killing in the mammalian world, averaging 0.3 per cent across more than one thousand species (Gómez, Verdú, González-Megías & Méndez 2016; see also Fry & Szala 2013; Roper 1969; Sala et al. 2015). The central focus here is on the origins of war, not on the homicides that the palaeontological evidence and phylogenetic context suggest have occurred infrequently for a very long time in the human evolutionary line (Gómez et al. 2016; Fry 2006; Fry, Schober & Björkqvist 2010; Roper 1969).

The one possible exception to the existence of war prior to the Holocene is Jebel Sahaba, recently redated to at least 11,600 BP (Antoine, Zazzo & Friedman 2013; Zazzo 2014). Jebel Sahaba may or may not reflect war, but certainly shows violence. Initially, 24 out of 59 individuals were seen as having suffered violent deaths due not only to embedded projectile points in their bones but also due to lithic points and barbs found in the burials. This is a very high percentage of violent death in a skeletal population, and some scholars attribute the killings to warfare or feuding, while others caution that an accumulation of homicides and executions over time may have occurred. Ferguson (2013b) points out another problem: the quantity and diversity of lithic material found in the burials – lithics inside skulls with no entry wounds for instance – provides tenuous support for violent death in some cases. Ferguson (2013b: 117) cautions that 'classifying all those [remains] with associated lithics as war casualties is going too far. Jurmain (2001: 20), a judicious specialist in palaeo-osteology, concludes the number of violent deaths actually should be counted as 4 out of 41 relatively complete skeletons, or 9.8 percent.'

An apparent massacre on the ancient shores of Lake Turkana in Africa at a then marshy place called Nataruk, dated to between 10,500 and 9,500 BP, may be the earliest evidence of warfare. Lahr et al. (2016a) report that for 10 of 12 articulated skeletons there is evidence of cranial and postcranial trauma. The authors also note the presence of pottery, a feature not typical of mobile foragers, and propose that some degree of sedentism and food storage are suggested by this evidence.

However, Stojanowski, Seidel, Fulginiti, Johnson, & Buikstra (2016) challenge the massacre interpretation, first pointing out that the cranial and skeletal damage corresponds with known taphonomic effects of soil compression, weathering cycles of wetness and dryness, and activities of insects, animals, and roots. While Stojanowski et al. (2016) do not dispute the evidence of violence in the case of an embedded obsidian lithic, they question whether all the deaths occurred at the same time and draw upon forensic anthropological knowledge to point out that much osteological damage at Nataruk is inconsistent with perimortum cranial trauma. Stojanowski et al. (2016: 539) conclude that 'interpersonal violence was surely present in early Holocene African hunter-gatherers, however, the case for a massacre at Nataruk is not supported by the data Mirazón Lahr et al. report.' In a brief reply, Lahr et al. (2016b: E10) dismiss the points raised by Stojanowski et al. (2016), maintaining that 'A case of intergroup conflict remains the best explanation of the events at Nataruk.' Perhaps further analyses will resolve some of these differences of interpretation.

Wishing to systematically assess the evidence for warfare older than 10,000 BP, Haas & Piscitelli (2013) made an extensive review of catalogues and site reports that contain information on skeletal material. Their survey resulted in data on nearly 3000 *Homo sapiens* skeletal remains from over 400 archaeological sites around the world. Out of these 400 sites older than 10,000 BP, Haas & Piscitelli (2013) discovered only four additional sites besides Jebel Sahaba where one or more individuals had projectile points embedded in their bones and one site with a multiple burial of three individuals. The remains in the multiple burial showed no sign of violence and the deceased could have succumbed to disease or some other calamity. Haas & Piscitelli (2013) note that none of the cases provide a basis for concluding the deaths resulted from war as opposed to accidents or homicide. Hass & Piscitelli (2013: 182–3) succinctly conclude, 'rather than demonstrating the commonness of ancient warfare amongst humans, consideration of the entire archaeological data set shows the opposite.' Out of nearly 3000 skeletal remains worldwide reviewed by Haas & Piscitelli (2013), only Jebel Sahaba and a handful of other sites showed any evidence of violence prior to 10,000 BP. An implication of these findings is that the assertion that *absence of evidence is not evidence of absence* of war simply does not ring true; with Jebel Sahaba remaining a puzzle of interpretation, there is evidence of occasional killing but no evidence of war across the 400 sites with nearly 3000 individuals worldwide. Similarly, Chatters (2014) reviewed all the Palaeo-Indian skeletal remains in North America pre-dating 9000 BP. His forensic conclusion is that the pattern 'is almost exclusively one of nonlethal fights between males within their own community and abuse of women and children by the same males' (Chatters 2014: 91).

Archaeological sequences demonstrating the origins of war in the Holocene. Importantly, the long chronology view that war originated hundreds of thousands, if not millions, of years ago also is contradicted by the numerous Holocene prehistoric sequences that document the origins of war before farming in some cases and in others reveal the recent origins of war along with plant domestication. A question that seems never to have been seriously addressed by those who argue that war has been ever-present as a natural feature of proto-human and human social life is: Why do multiple prehistoric time sequences show the birth of war in different places across the Holocene? And why, as illustrated in the comparative forager findings of the

Table 18.5. *The origin of war on Kodiak Island in the North Pacific.*

Approximate dates/period	Housing	Prestige trade	Warfare
7500–5100 BP Ocean Bay 1	Portable	Low importance	Minimal if at all
5100–3800 BP Ocean Bay 2	Portable then permanent	Low importance	Minimal if at all
3800–2600 BP Early Kachemak	Permanent	Low importance	Minimal if at all
2600–700 BP Late Kachemak	Permanent	Moderate importance	First use of defendable landforms; minimal then sporadic
700–200 BP Early & Late Koniag	Permanent	High importance	Defensive villages; endemic fighting

Note: The extent of warfare is estimated from number of defensive sites. Sources are Fitzhugh & Kennett (2010: see Table 6.1) and Fitzhugh (2003a, b).

current study, do these archaeological sequences follow similar developmental narratives that involve increasing complexity, including rising population densities?

On Kodiak Island the archaeological record goes back at least 7500 years. For the first 5000 years, evidence of war is non-existent (Table 18.5). Fitzhugh (2003) reports the first use of small defendable landforms such as placing camps on steep slopes and promontories at about 1100 BP. A few centuries later, large defensible villages appear in the archaeological record. Fitzhugh & Kennett (2010: 73) explain that inequality arose along with the development of whale hunting 'and eventually expands to embrace large-scale, endemic warfare mobilized by large boats and long-distance raids.'

Dye (2009, 2013) outlines the grand sequence that took place in eastern North America, beginning about 13,000 BP with a nomadic forager phase and concluding with settled agricultural societies at the time of European contact (Table 18.6). While cognizant of local variations, Dye (2009, 2013) highlights three broad phases in lethal aggression and social complexity in eastern North America: nomadic foraging and interpersonal homicides for about 6 millennia, then the rise of villages and feuding beginning about 7000 BP, and finally the appearance of larger polities, alliances, long-distance trade, and war about 3000 BP (Table 18.6).

The next sequence showing the birth of war along with social complexity comes from the Valley of Oaxaca in Mexico (Flannery & Marcus 2003, 2012). The archaeological record begins at 10,000 BP with over 6000 years of mobile forager camps and no evidence of warfare. Subsequently, the arrival of war

Table 18.6. *The origins of war in eastern North America.*

Dates	Types of violence	Social organization and features
13,000–7000 BP	Homicide	Non-segmented, mobile, family-level foragers
7000–3000 BP	Feuding, raiding	Segmented non-egalitarian tribal-like foragers; settlements appear; trade develops
3000–300 BP	Warfare appears	Villages and towns, some palisaded for defence; chiefly societies based on farming; alliance systems, long- distance trade, domination and tribute

Source: Table is based on information in Dye (2009, 2013).

Table 18.7. *The origin of war in the Valley of Oaxaca, Mexico.*

Dates	Types of violence	Social organization and features
10,000–4000 BP	'Warless societies'	Nomadic camps
3600+ –2800 BP		Village life begins; social segments arise
2800–2450 BP	Raiding and 'chiefly warfare'	Three chiefly centres with buffer zones between them
2450–2000 BP	Full-scale warfare	Development of the ancient Zapotec state
2000–1700 BP	Military expansion and conquest	State expands into neighbouring areas

Source: Table based on information in Flannery & Marcus (2003, 2012).

is unmistakably visible in the archaeological record, as is the rise of the Zapotec state and its concomitant militarism (Table 18.7). Again a regional archaeological sequence shows war to arise from an absence of warfare congruently with other major social changes.

Turning to Europe and the Near East, Ferguson (2013a) reviewed all the available archaeological evidence for each region to evaluate the presence or absence of war and interpersonal aggression across time. Ferguson (2013b: 116) summarizes:

> *By considering the* total *archaeological record of prehistoric populations of Europe and the Near East up to the Bronze Age, evidence clearly demonstrates that war began sporadically out of warless condition, and can be seen, in varying trajectories in different areas, to develop over time as societies become larger, more sedentary, more complex, more bounded, more hierarchical, and in one critically important region [the Near East], impacted by an expanding state.*

It is important to highlight the methodology employed by Ferguson (2013a) consisted of assessing in a region *all* available archaeological evidence for the presence or absence of war and violence as contrasted with the practice of merely presenting a limited subset of examples of violence as if they were representative of the archaeological record (e.g., see Bowles 2009; Keeley 1996; Pinker 2011).

Taking a methodological leaf from Ferguson's book, Nakagawa, Nakao, Tamura, Arimatsu, Matsumoto & Matsugi (2017) and Nakao, Tamura, Arimatsu, Nakagawa, Matsumoto & Matsugi (2016a, b) reviewed all of the available skeletal evidence for Japan looking for any signs of perimortum trauma across the Jōmon forager period, beginning 15,000 BP, and then for the Yayoi agricultural period, 2800 to 1250 BP (Table 18.8). During the forager period, there was evidence of lethal violence but no fortifications or weapons of war; during the farming period, there were fortifications, weapons, and significantly more cases of violent death.

Worldwide archaeological findings show that war originated multiple times in the Holocene and, in correspondence with both a corpus of ethnographic data and the comparative forager findings reported here, also show that war develops along with socio-political complexity. Archaeology shows transitions from warlessness to warfare occurring at different places at different times: 800–750 BP among the Anasazi of the North America; 2000 BP in Northwest Alaska; by 2800 BP in the Valley of Oaxaca; 9500 BP in parts of the Near East; and perhaps earlier than 11,600 BP at Jebel Sahaba (Antoine et al. 2013; Darwent & Darwent 2014; Ferguson 2013a; Flannery & Marcus 2003, 2012; Fry 2006; Haas 1999, 2001). The big picture views from worldwide archaeology and comparative forager studies on the origins and development of war correspond with and complement one another.

Table 18.8. *Skeletal evidence for lethal violence and the origin of war in Japan.*

Dates/ period	Skeletal population	Per cent deaths due to violence	Social organization and features
15,000–2800 BP Jōmon Period	1051	1.81	Forager period of Japanese prehistory; no evidence of weapons or fortifications
2800–1250 BP Yayoi Period	1936	3.62	Agricultural period; first evidence of weapons and fortifications

Source: Table is based on information in Nakao et al. (2016a, b) and Nakagawa et al. (2017).

Conclusions and philosophy of science reflections

The findings from comparative forager ethnography and data from archaeology are mutually reinforcing. Neither comparative forager studies nor archaeology show mobile forager band social organization to be conducive to warfare. Archaeological sequences from various regions demonstrate that the origins of war correlate with complexification, including increases in population density, among both foragers and the first farmers. Thus, in considering the antiquity and origins of war, the data clearly favour the interpretation that war arrives along with complexification.

Weaknesses of the long chronology of war include, first, the absence of a theoretical model for predicting war under Pleistocene forager demographic and social conditions, second, the lack of actual *evidence* of warfare in the deep past (saying *absence of evidence is not evidence of absence* is no substitution for actually providing *evidence* of war), and, third, unfamiliarity with the well-documented and geographically diverse sequences showing that war originates as part of complexification.

Several suggestions can be offered for making the study of the origin and development of warfare more scientifically grounded. We can start by questioning whether the dichotomization of researcher views is useful for framing the problem and moving science forward. Categorizing researchers as long versus short chronologists, hawks versus doves, or Rousseauan versus Hobbesian (Allen 2014; Gat 2015; Jones & Allen 2014; Pinker 2011) puts the focus on researchers rather than on theory, methods, and data and emphasizes competition between 'camps' rather than on collaboration in the scientific quest for knowledge. We therefore advocate a closer adherence to the ideals and cannons of the scientific approach, as a collaborative venture, aimed at understanding the origins and antiquity of warfare. A reconceptualization could return the central scientific focus to (1) theory development and theory-driven hypothesis testing, (2) greater attention to sampling and other methodological elements, and (3) self-reflection and self-awareness about how cultural and personal biases and implicit assumptions impact our work. We will now explore why we see philosophy of science reflections on the scientific enterprise as especially necessary concerning the origins and antiquity of warfare.

Theory development and hypothesis testing

We advocate expanding the frame of reference and taking a more holistic view of the data in order to formulate knowledge-based hypotheses and to thus enhance the quality of research. To expand the relevant frames of reference related to the origins and antiquity of war, data appropriate for theory development and hypothesis generation could include areas of knowledge such as non-human primates, especially humankind's closest ape relatives, patterns of fighting and lethality in mammals more generally, human palaeontology and deep-past archaeology, data on the progression of complexification in the Holocene prehistoric record, comparative ethnography and ethnohistory with special attention to mobile and settled forager societies, and so on. The anthropological study of war seems to have suffered from the unnecessary narrowing of focus, for example, as models about war in human deep prehistory are derived from limited spheres of information. For example, the development of a war model based on observations of coalitional intergroup killings in chimpanzees but without information on non-raiding bonobos and more broadly without knowledge from other relevant realms (e.g., mammalian aggression, archaeology, and social organization) is unlikely to provide a comprehensive explanation (Wrangham & Glowacki 2012). Similarly, propositions about prehistoric war based on the assumption that forager bands were self-contained independent units subject to group selection (cf. Bowles 2009) can be called into question by copious data on mobile forager band social organization and demographic conditions (cf. Fry 2006; Marlowe 2010).

Furthermore, we suggest that citing cases of violence and/or war in the archaeological records is not enough to prove that war is ancient and hence an evolved human proclivity. Instead, a wider framing of the topic that takes into account, first, evolutionary theory explicitly (Fry 2018) and, second, additional demographic, subsistence, social, and ecological factors – including temporal sequences in the archaeological record that show change, as considered here – could help produce new insights and move science forward. As we have considered in this chapter, archaeological sequences that include shifts toward complexity tell us much about the origins of war. The approach we are advocating includes applying a more holistic, comprehensive frame of reference to this topic of study (Fry 2018).

Giving more attention to sampling, methodology and definitions

Studies of prehistoric war seem to reflect more than their share of methodological problems, such as lack of systematic sampling when using archaeological and ethnographic data, or reliance on secondary rather than primary sources (see critiques in Ferguson 2013a, b; Fry 2006, 2013, 2018; Fry & Söderberg 2014). For example, the estimate that 14 per cent of deaths in prehistory were due to warfare (Bowles 2009; Pinker 2011) can be called into question, not only due to being based on self-selected archaeological and ethnographic samples, but also because a cherry-picking approach to sampling yields a value that is contradicted by various other sources (Chatters 2014; Fry 2013; Gómez et al. 2016; Haas & Piscitelli 2013; Ferguson 2013a, b).

Similarly, interpretations become problematic when illustrations of forager violence and warfare are selected without a rigorous sampling scheme and without considering the societal features and context of the selected cases. A case in point, one of the six ethnographic examples selected by Wrangham & Glowacki (2012) to illustrate forager violence and warfare was the Iñupiat of Northwest Alaska, an Inuit society that engaged in war and showed more political complexity than the other Inuit societies of the Canadian and Greenland Arctic (Buela, this volume). Darwent & Darwent (2014: 182) explain that 'violent conflict was frequent, large-scale, pervasive, and brutal' among the Iñupiat of Northwest Alaska, but for 12 other Inuit groups to the east 'the opposite was the case: larger-scale conflicts, which some would characterize as warfare, were almost unheard of among Inuit peoples.' In other words, the Inuit society selected by Wrangham & Glowacki (2012) to illustrate the occurrence of war was undergoing complexification in comparison to numerous more peaceful Inuit groups to the east. Unlike the other 12 Inuit societies of the North American Arctic – and nearly all mobile foragers societies in general – the Alaskan Iñupiat were 'hunter-gatherers of intermediate complexity' and socially segmented into 'nations' (Burch 2005: 5). Darwent & Darwent (2014: 187) expand on the contrast between the Iñupiat of the northwest and the other Inuit societies, noting:

> *The cultural emphasis on war in the west: young men were specifically trained to be warriors, and there was admiration for those who participated in larger-scale violence and were good killers. This was in contrast to the east, where there was no preparation or training for war among the young men; rather, skill as a hunter was revered about all and there was no exaltation of men who killed others.*

Various researchers have pointed out that it is not always possible to tell whether archaeological evidence of lethal trauma reflects war, feud, a hunting accident, homicide, a socially sanctioned execution, or something else (Allan et al. 2016; Ferguson 1997, 2013a, b). This is a situation where expanding the frame of reference to encompass knowledge of forager ethnography could aid with interpretation in some, but not all, archaeological circumstances. For example, the findings of Fry & Söderberg (2013a, b; see also Hill et al. 2007; Griffin 2000) on lethal aggression at the mobile forager band level of social organization form a basis for predicting that when the archaeological context consists of mobile foragers, cases of lethal violence would typically involve personal motives and reflect homicide and manslaughter rather than war.

Turning to definitional issues, we suggest that researchers in this area pay attention to how they operationalize concepts and also be aware of 'concept drift'. A recurring scenario involving concept drift occurs when the topic under consideration begins as *war*, but then implicitly shifts to encapsulate *other types of lethal aggression*. A variation of this problem occurs when various types of lethal aggression are simply assumed to be war although the evidence does not preclude homicide, accidents, or executions of deviants as viable alternative interpretations to war. Pinker (2011: 48–50), for instance, ostensibly focuses on *warfare*, but then shifts his discussion to 'percentage of all deaths that are caused by violence', and later to 'rate of violent death', and then back to 'rates of death by warfare', causing uncertainty as to whether he means all types of violent death or only war deaths.

Another issue is when a definition of war diverges from the general understanding of the concept. Bowles (2009: 1294) removes the seemingly fundamental condition of lethality and substitutes 'bodily harm' when he defines war as 'events in which coalitions of members of a group seek to inflict bodily harm on one or more members of another group'. Wrangham & Glowacki (2012: 8) adopt Bowles' (2009) definition but add the phrase at the end, '"groups" are independent political units'. Fry & Söderberg (2013a, b) took a different approach and, rather than attempting to distinguish war from other types of lethal aggression at the onset of their research, focused instead on documenting and analysing the salient characteristics of killing events. In presenting both the specifics of 148 cases of mobile forager lethal aggression (Fry & Söderberg 2013b) and an overall analysis of the lethal aggression (Fry & Söderberg 2013a), the researchers provide the raw data upon which the conclusion rests that war – *relatively impersonal lethal aggression between communities* – is uncommon among nomadic foragers.

Assumptions versus self-reflection

If any discipline of scholars would be expected to appreciate the powerful sway of cultural beliefs on human perception, thought, and action, it would be anthropologists. The Western view of human nature as selfish and violent long predated philosopher Thomas Hobbes (1588–1679) and continues to this day. Sahlins (2008) traces a Western perception of a selfish, violent nature back to the Greeks two millennia ago, through Saint Augustine's emphasis on *Original Sin*, Machiavelli's view of men as 'ungrateful, fickle, liars and deceivers, fearful of danger and greedy for gain' (Machiavelli quoted in Sahlins 2008: 64–5), and onward through history to Alexander Hamilton's characterization in 1788 that 'fiery and destructive passions of war reign in the human breast with much more powerful sway than the mild and beneficent sentiments of peace' (Hamilton, n.d.). Freud's (1961: 59) assertion that history shows a litany of people behaving as 'savage beasts' also fits this tradition.

The conceptions of a greedy, warlike human nature akin to those of Thucydides, Machiavelli, Hobbes, Hamilton, and Freud continue to arise regularly in the media and in academic fields from biology and psychology to primatology and archaeology (Fry 2006; Sponsel 2016; Sussman 2013). In the 1950s anatomist Raymond Dart drew upon Australopithecine fossils to argue that humankind is not really so kind (Fry 2006). This classic Western assumption of a violent human nature also manifests itself in popularized science writings such as *The Dark Side of Man* (Ghiglieri 1999), *Demonic Males* (Wrangham & Peterson 1996), the *Murderer Next Door* (Buss 2005), and *Nobel Savages* (Chagnon 2013). 'If one traces these theories into the history of modern biology, we can see that the Hobbesian view has predominated,' concludes Sussman (2013: 99).

Fry (2006) has argued using many examples from anthropology and related fields that cultural beliefs about war affect the work of scientists and scholars. It seems unlikely that scientists and scholars born and raised in a cultural milieu where Hobbesian narratives of human nature predominate would not be affected in various ways. Hence one of our prescriptions for researchers working in this area involves the sometimes difficult tasks of self-reflection, self-awareness, and self-questioning in light of their cultural traditions, professional schooling, and social meanings as reflected in extant values, beliefs, and practices.

Darwin (1958: 123) self-reflected on his own tendency to dismiss observations that seemed to be unsupportive of his theorizing, writing, 'I had, also, during many years, followed a golden rule, namely, that whenever a published fact, a new observation or thought came across me, which was opposed to my general results, to make a memorandum of it without fail and at once; for I had found by experience that such facts and thoughts were far more apt to escape from the memory than favorable ones.' We think researchers focusing on the origins and antiquity of war could learn from Darwin's mindful approach and work more collaboratively with less bias toward the shared goals of scientifically investigating war and peace.

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Note

1. Roscoe (2014: 226) among others has proposed that recent foragers 'inhabited extremely marginal environments'. However, drawing on large world-wide samples of foragers, Binford (2001) and Marlowe (2010) show that this is not the case. Marlowe (2010: 258) notes a bias in viewing habitats in agricultural terms, pointing out that 'some areas unsuitable for planting can be quite good for foraging'. Based on his sample of nearly four hundred foragers, which includes the current SCCS sample of 30 forager societies, Binford (2001: 137, 158) concludes that foragers rarely live in deserts, semi-desert scrub, and high altitudes. 'In spite of numerous generalizations in the anthropological literature asserting that hunter-gatherers could be found in the recent era only in the most marginal or nonproductive habitats, I discovered that *truly* nonproductive habitats were occupied exclusively by pastoralists and agriculturalists' (Binford 2001: 158, emphasis in original).

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Appendices to Chapter 9

Responses of Upper Palaeolithic humans to spatio-temporal variations in resources: inequality, storage and mobility

William Davies

APPENDIX A.

Table 9.A1. *Immediate- and delayed-return systems (Woodburn (1982, 2005)). These are not binary opposites, but extremes of a continuum of variation; many hunter-gatherer groups contain elements of both systems (though Woodburn (1982: 433) argues that immediate-return strategies practised by delayed-return societies are limited and have a low social value placed upon them).*

Immediate-return	Delayed-return
People obtain a direct and immediate return from their labour: eat the food foraged on the same day, or soon after. Social groupings are flexible, and fluid in composition. People free to move from one camp to another (temporarily or permanently) without penalty or loss of vital interests.	People hold rights over valued assets, which represent a yield, a return for labour and time, or are effectively managed as 'delayed yields on labour' (1982: 433). Four main types of asset (generally found in combination):
• Relatively simple, portable, utilitarian, easily acquired, replaceable tools and weapons, made with real skill but not involving a great deal of labour (cf. Bleed's (1986) Maintainable technology). No *dependence* on sharing/ pooling of resources or equipment (e.g. weapons, nets). Valued assets are temporary, e.g. carcass of a large animal, and are not accumulated. • Food is neither elaborately processed nor stored (cf. Binford's (1980) Foragers and Bettinger's (1991) Travellers), though portable storage is possible in small quantities. Nomadism is fundamental, with no fixed locations (dwellings, base-camps, hunting/fishing apparatus, ritual sites), resources or assets to constrain movement. • No management or control of resources: all individuals have direct access, though limited by sexual division of labour, to the uncollected resources of their territories/ranges. Potential defence of some fixed resources, e.g. patches of predictable plant foods. • Systematically eliminate distinctions (except those between sexes and initiated/uninitiated) of wealth, power and status. More autonomy for women than in delayed-return systems.	• Valuable (owing to manufacturing time, effort and expertise) technical production facilities that yield food gradually over months or years, e.g. boats, nets, fish weirs, stockades, traps (cf. Bleed's (1986) Reliable technology). • Processed and stored food or materials, usually in fixed dwellings (cf. Binford's (1980) Collectors and Bettinger's (1991) Processors). • Wild products that have been improved or increased by human labour (cf. Resource Management (Williams & Hunn 1982)). • Female kin bestowed by their male relatives in marriage alliances.
• People not dependent on *specific* others for access to basic requirements. All interpersonal relationships (not just kinship) emphasize sharing and mutuality, though not necessarily long-term or binding. • Weaponry provides direct and immediate access to social control; not mediated through formal institutions or through interpersonal relationships. No formal heads of household, though some individuals may have influence on certain group decisions. • Children generally have freedom to make choices: learning self-reliance. • Unrestricted access to food, water, other resources (shelters, tools/weapons, trading items) and ornaments. Equality of opportunity for individuals in access to resources (limited by sexual division of labour) is not always matched by equality of yield (those vary by skill, luck, persistence, capacity to work, etc.) (cf. Zubrow 2010). Flexible rules for acquisition of possessions: no-one depends on inheritance or formal transmission by preceding-generation close kin.	• Binding commitments and dependencies between people (based on kinship or contract), to secure yields and manage assets. People are bound to close kin and affines in relationships that commonly involve the constant exchange of goods and services in fulfilment of obligations; bound to each other through material obligations and interpersonal responsibilities. • Acephalous delayed-return societies show competition between heads of household (egalitarianism is horizontal, within social classes, and maintained by equal exchange of things of the same type – cf. Zubrow 2010) for wealth, prestige and status. • Intergenerational inequality; heirs controlled by their fathers (heads of household). • Relationships and access to resources are not equal between household heads, their wives, female kin and junior male kinsmen.
Individuals can choose their associates during residence, foraging, trade and exchange, and in ritual contexts. This right is constantly exercised, limiting enduring bonds and inhibiting development of authority and intragroup dependency. Fission-fusion used to resolve intragroup tensions. Group members often eat when they wish (if food available); allocated resources from sharing will be consumed by whoever happens to be around.	Vertical control of food and other resources (including assets), and access to them, helping to differentiate group members. Food often consumed in communal meals (allocations can be controlled, even for the heirs of household heads). Restricted ability to move between groups without penalty.
Religion and ritual: consecrated sharing in the context of joint participation of the whole community, even if select individuals might act as channels for numinous forces. Ability to become healers or to learn and practise religious beliefs and rituals not restricted or controlled.	Cults and restricted knowledge; using secret material and intellectual property of initiates; sacred objects often concealed in the landscape, and protected by secrecy, deception and threats of violence against non-initiates. Male cults often more powerful and elaborated than female ones, even in societies that are egalitarian in secular contexts. Within initiates, sacred knowledge can be shared in a less-restricted fashion.

APPENDIX B.

Table 9.B1. *Effective Temperature and Net Primary Productivity values for ethnographic foraging groupings and estimates for 42 ka, 30 ka and 21 ka. 'Q1' = first quartile; 'Q3' = third quartile. Ethnographic data from Binford (2001) and Kelly (2013).*

	Effective Temperature (ET): °C							**Net Primary Productivity (NPP): grammes carbon per sq. m per year**						
Ethnographic	*N*	**Mean & SD**	**Min**	**Q1**	**Median**	**Q3**	**Max**	*N*	**Mean & SD**	**Min**	**Q1**	**Median**	**Q3**	**Max**
Polar	*17*	9.7 ± 0.8	8.5	9.0	9.5	10.3	11.6	*13*	158.4 ± 101.3	45	89	115	209	333
Sub-polar/cold forests	*35*	11.0 ± 0.8	9.0	10.5	10.9	11.25	12.7	*21*	402.9 ± 180.9	144	245	354	533	772
Pacific Northwest Coast	*18*	11.6 ± 0.8	10.5	11.1	11.7	12.3	12.7	*14*	795.7 ± 95.1	633	729.25	825	855.75	943
Plateau (forests)	*11*	12.7 ± 0.5	12.1	12.4	12.6	13.3	13.3	*8*	343.5 ± 77.4	259	284.5	319	389.25	464
Plains	*10*	12.9 ± 1.3	11.3	11.6	13.1	14.1	14.6	*9*	534.9 ± 242	283	397	432	706	1045
Great Basin	*19*	13.0 ± 0.9	11.7	12.4	12.9	13.6	15.0	*14*	250.7 ± 150.2	45	163.75	210.5	306	583
California	*32*	13.8 ± 0.7	12.7	13.3	13.8	14.4	15.0	*14*	564.9 ± 202.2	26	478.75	567	697.25	812
42 ka:														
Europe	*2424*	11.8 ± 1.2	7.7	11.1	11.9	12.6	14.7	*2424*	245.2 ± 97.1	2	179	248	307	624
Cantabria	*7*	10.6 ± 0.6	9.8	10.1	10.8	11.0	11.2	*7*	63.3 ± 84.8	0	0	0	118	207
Southwest France	*6*	12.3 ± 0.2	11.9	12.4	12.4	12.4	12.5	*6*	311.8 ± 30.5	273	290.5	310.5	335	350
Moravia	*2*	12.1 ± 0.2	12.0	12.0	12.1	12.1	12.2	*2*	283.5 ± 10.6	276	279.75	283.5	287.25	291
30 ka:														
Europe	*2293*	11.8 ± 1.1	7.6	11.1	11.7	12.6	14.5	*2293*	231.5 ± 92.2	1	169	237	290	595
Cantabria	*6*	10.3 ± 0.6	9.6	9.7	10.1	10.7	11.1	*6*	65.0 ± 52.8	0	20.25	84	93	127
Paviland	*1*	N/A	10.2	N/A	N/A	N/A	10.2	*1*	N/A	134	N/A	N/A	N/A	134
Southwest France	*7*	12.2 ± 0.2	11.8	12.1	12.2	12.3	12.4	*7*	292.9 ± 19.4	260	282.5	298	304.5	318
Moravia	*4*	11.8 ± 0.1	11.6	11.7	11.8	11.8	11.9	*4*	266.0 ± 13	257	257.75	261	269.25	285
Sunghir	*1*	N/A	11.4	N/A	N/A	N/A	11.4	*1*	N/A	272	N/A	N/A	N/A	272
21 ka														
Europe	*1792*	11.2 ± 1.1	7.6	10.4	11.1	12.1	14.1	*1792*	215.7 ± 99.9	1	153	216.5	271	731
Cantabria	*4*	10.0 ± 0.2	9.7	9.9	10.1	10.1	10.1	*4*	122.3 ± 198.8	0	0	36.5	158.75	416
Southwest France	*4*	11.0 ± 0.05	11.0	11.0	11.0	11.1	11.1	*4*	288.3 ± 3.5	284	286.25	288.5	290.5	292
Moravia	*1*	N/A	10.9	N/A	N/A	N/A	10.9	*1*	N/A	194	N/A	N/A	194	194

APPENDIX C: DEMOGRAPHY.

Table 9.C1. *Modelled/Estimated Upper Palaeolithic regional populations and densities (see below table for notes).*

			Metapopulation				Density (persons per 100 sq. km)				
Details	**Occupation area (sq. km)**	**Site N**	**Mean**	**Range**	**Median**	**Interquartile range**	**Mean**	**Range**	**Median**	**Interquartile range**	**Regional group N**
Hahn (1977):											
Central & Eastern Europe Aurignacian	[5,000,000–10,000,000]	N/A	500,000–1,000,000					10.0–20.0			
Straus (1986):											
Eastern Asturias (Magdalenian)	1250	N/A	200–250 (scaled up to 2000–25,000)					16–20			
Biraben (1988):											
France:											
Châtel.-Aurig-Gravettian	*c.* 550,000–700,000	209 (410)	*c.* 8000–10,000					1.14–1.82			
Aurignacian-Gravettian	*c.* 550,000–700,000	?	*c.* 9000					1.29–1.64			
Solutrean	*c.* 700,000	66 (520)	15,000–20,000					2.14–2.86			
Magdalenian	*c.* 550,000–700,000	301 (480)	15,000–20,000					2.14–3.64			
Delpech (1999: 36):											
c. 21–22 ka (*c.* 18,000 uncal. BP)	100,000	N/A	750				0.75				
c. 17–19 ka (14,000–16,000 uncal. BP)	600,000	N/A	49,500				8.25				
c. 15.4–17 ka (14,000–13,000 uncal. BP)	1,500,000	N/A	258,750				17.25				
Rozoy (2001; 1996):											
Final Magdalenian:											
Perigord – Vienne + Quercy	35,000	*c.* 154	6000 (6500)				17.14 (18.57)				
Pyrenees	35,000	87	N/A (2500)				N/A (7.14)				
Massif central	25,000	63	N/A (1500)				N/A (6.0)				
Provence-Languedoc	15,000	>25 (23)	2500 (1000)				16.67 (6.67)				
Saone-Alpes	20,000	39	N/A (1500)				N/A (7.5)				
Pincevent-Ardenne	15,000	36	1200–1500 (1000)				8.0–10.0 (6.67)				
Bocquet-Appel & Demars (2000):											

Table 9.C1 *(cont.)*.

			Metapopulation				**Density (persons per 100 sq. km)**				
Details	**Occupation area (sq. km)**	**Site N**	**Mean**	**Range**	**Median**	**Interquartile range**	**Mean**	**Range**	**Median**	**Interquartile range**	**Regional group N**
Aurignacian: southwest France	65,700 (57,800)	159	3421				5.21 (5.92)				
Rest of France	545,800 (486,400)	60	1303				0.24 (0.27)				
Britain, Low Countries, Germany	831,200 (585,300)	32	706				0.08 (0.12)				
Gravettian: southwest France	65,900 (57,800)	119	4429				6.72 (7.66)				
Rest of France	561,600 (486,400)	61	2254				0.4 (0.46)				
Britain, Low Countries, Germany	950,400 (585,300)	29	1088				0.11 (0.19)				
Solutrean/Badegoulian (LGM): southwest France	75,300 (57,800)	136	5541				7.36 (9.59)				
Rest of France	579,400 (486,400)	83	3396				0.59 (0.7)				
Britain, Low Countries, Germany	296,100 (245,000)	0	0				0 (0)				
Magdalenian: southwest France	65,900 (57,800)	194	10,046				15.24 (17.38)				
Rest of France	561,600 (486,400)	294	15,271				2.72 (3.14)				
Britain, Low Countries, Germany	950,400 (585,300)	284	14,860				1.56 (2.54)				
Kretschmer (2015); Maier et al. (2016); Maier & Zimmermann (2017); Schmidt & Zimmermann (2019):											*Median (Q1–Q3):*
Portugal: earlier Gravettian	12,493				156	179–131			1.25	1.43–1.05	3.6 (4.2–3.0)
Later Gravettian	18,798				159	194–102			0.85	1.03–0.54	3.7 (4.5–2.4)
LGM	15,883				221	429–88			1.39	2.7–0.55	5.1 (10.0–2.1)
Southern Spain: LGM	17,395				242	469–97			1.39	2.7–0.56	5.6 (10.9–2.3)
Southeast Spain: LGM	8128				113	219–45			1.39	2.69–0.55	2.6 (5.1–1.1)
Eastern Spain: LGM	7183				100	194–40			1.39	2.7–0.56	2.3 (4.5–0.9)
Northeast Spain: LGM	53,63				75	145–30			1.4	2.7–0.56	1.7 (3.4–0.7)
Northern Spain: Aurignacian	18,973				264	134–818			1.39	4.31–0.71	6.2 (19.3–3.1)
Earlier Gravettian	21,270				265	305–223			1.25	1.43–1.05	6.2 (7.1–5.2)

Table 9.C1 *(cont.)*.

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Later Gravettian	15,900				135	164–86			0.85	1.03–0.54	3.1 (3.8–2.0)
Iberia: Upper-Final Magd.	57,000				2990	1750–3550			5.3	6.2–3.1	69.5 (40.7–82.6)
Pyrenees: Aurignacian	2809				39	20–121			1.39	4.31–0.71	0.9 (0.5–2.9)
Upper-Final Magd.	18,900				80	70–160			0.4	0.8–0.4	1.8 (1.7–3.6)
Southwest France: Aurignacian	31,430				437	221–1356			1.39	4.31–0.71	10.3 (31.9–5.2)
Earlier Gravettian	60,201				793	1010–313			1.32	1.68–0.52	18.4 (23.5–7.3)
lLater Gravettian	32,920				279	340–178			0.85	1.03–0.54	6.5 (7.9–4.1)
Franco-Cantabria: LGM	135,574				1887	3659–755			1.39	2.7–0.56	43.9 (85.1–17.6)
Early Magd.									0.16	0.004–0.31	
Middle Magd.									0.18	0.11–0.32	
Upper Magd.									0.48	0.3–0.56	
Final Magd.									0.48	0.3–0.55	
(Southwest France:) Upper-Final Magd.	26,600				1850	1180–2080			7.0	4.4–7.8	42.9 (27.4–48.4)
Narbonne/Aude: Aurignacian	4600				64	32–198			1.39	4.31–0.71	1.5 (4.7–0.8)
West Central France: Aurignacian	3080				43	22–133			1.39	4.31–0.71	1.0 (3.1–0.5)
Central-southwest France: Upper-Final Magd.	33,200				210	130–390			0.6	0.4–1.2	4.8 (3.1–9.1)
Burgundy: Earlier Gravettian	25,308				333	425–132			1.32	1.68–0.52	7.8 (9.9–3.1)
Later Gravettian	14,951				127	155–81			0.85	1.04–0.54	2.9 (3.6–1.9)
Jura/W. Alps: Upper-Final Magd.	28,900				260	150–410			0.9	0.5–1.4	6.0 (3.4–9.6)
Paris Basin: Upper Seine valley: LGM	16,205				226	437–90			1.39	2.7–0.56	5.2 (10.2–2.1)
(Paris Basin:) Upper-Final Magd.	10,700				240	170–380			2.2	1.6–3.6	5.5 (4.0–8.9)
South Rhône: Aurignacian	5792				81	41–250			1.39	1.39–0.71	1.9 (5.9–1.0)

Table 9.C1 *(cont.)*.

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Earlier Gravettian	9693				121	139–101			1.25	1.43–1.04	2.8 (3.2–2.4)
Later Gravettian	11,853				100	123–64			0.84	1.04–0.54	2.3 (2.9–1.5)
Southern France: LGM	19,114				266	516–106			1.39	2.7–0.55	6.2 (12.0–2.5)
Provence: earlier Gravettian	6507				81	93–68			1.24	1.43–1.05	1.9 (2.2–1.6)
Later Gravettian	0				0	0			0		0
Provence/Liguria: LGM	6017				84	162–33			1.4	2.69–0.55	1.9 (3.8–0.8)
Britain: Upper-Final Magd.	12,700				160	120–260			1.3	0.9–2.0	3.7 (2.8–6.1)
Belgium: Aurignacian	7276				218	153–308			3.0	4.23–2.1	5.1 (7.2–3.6)
Earlier Gravettian	19,731				328	489–194			1.66	2.48–0.98	7.6 (11.4–4.5)
Rhine-Meuse: Upper-Final Magd.	19,800				230	130–440			1.2	0.7–2.2	5.3 (2.9–10.3)
Upper Danube: Aurignacian	4654				140	98–197			3.0	4.23–2.1	3.3 (4.6–2.3)
Earlier Gravettian	20,361				187	313–174			0.92	1.54–0.85	4.4 (7.3–4.1)
Later Gravettian	0				0	0			0	0	0
Swabian-Franconian Alb: Upper-Final Magd.	21,700				460	140–310			2.1	1.4–5.3	10.6 (7.1–26.5)
Northwest Czech republic: Aurignacian	1216				10	7–15			0.84	1.24–0.59	0.2 (0.4–0.2)
Middle Danube: Danubian/Moravian Aurignacian	19,720				166	117–244			0.84	1.24–0.59	3.9 (5.7–2.8)
Earlier Gravettian	56,723				292	421–152			0.51	0.74–0.27	6.8 (9.8–3.5)
Later Gravettian	23,692				172	459–128			0.73	1.94–0.54	4.0 (10.7–3.0)
Central Europe: LGM	22,159				32	53–30			0.14	0.24–0.14	0.8 (1.2–0.7)
Southern Poland (Kraków): Aurignacian	2865				24	17–35			0.84	1.24–0.59	0.6 (0.8–0.4)
Upper Tisza: Aurignacian	2678				33	11–72			1.23	2.71–0.39	0.8 (1.7–0.2)
Middle Tisza: Aurignacian	2095				26	8–57			1.23	2.71–0.39	0.6 (1.3–0.2)
Prut: earlier Gravettian	10,753				224	290–182			2.08	2.7–1.69	5.2 (6.8–4.2)

Table 9.C1 *(cont.).*

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Later Gravettian	5696				41	110–31			0.72	1.93–0.54	1.0 (2.6–0.7)
LGM	22,392				33	46–31			0.15	0.21–0.14	3.7 (4.5–2.4)
Eastern Central Europe: Upper-Final Magd./ Epigravettian	18,200				170	110–270			0.9	0.6–1.5	4.0 (2.6–6.2)

Notes:

Hahn (1977):	Based on site and intra-site structure sizes, artefact/faunal remains densities, and ethnographic comparisons. ≥2500 people assumed to have lived in western Germany (based on Lone & Ach valleys, Wildscheuer and Lommersum); if missing evidence is considered, the same area did not have more than 25,000 people. Local group sizes of 20–30 people.
Straus (1986):	For southernmost (warmer) part of eastern Asturias (10,000–15,000 sq. km): 200–250 people in an autonomous regional group within a fraction of that territory (1250 sq. km today: slightly larger in Lateglacial?). Calculation is based on 80–100 red deer herds of 100 individuals each, supporting 8–10 specialist 25-person bands.
Biraben (1988):	Dupaquier found it hard to distinguish Châtelperronian, Aurignacian and Gravettian, owing to temporal overlap. Demic increases attributed to the Solutrean & Magdalenian, in part owing to technological developments. Estimate (a) was derived from site numbers in the *Atlas Archéologique Universel* (1978) (numbers multiplied by factor of 10); that in (b) was derived from site numbers in *La Préhistoire Française* (1976). Number of sites over duration of technocomplex is scaled by a Restitution Coefficient (logarithmic logistic curve): weighting of earlier technocomplexes was increased to avoid over-dominance of most recent Palaeolithic.
Delpech (1999):	Estimating LGM-Lateglacial ungulate productivities (and resultant human population densities) for the region stretching from north of the Pyrenees and across to the east of Poland (mostly the North European Plain).
Rozoy (1996 & 2001):	Site N, mean meta-population & population density values taken from 2001 paper, with 1996 ones in parentheses. 1996: Based on prey productivity (boar & red deer) and energy requirements. Cantabrian estimate taken from Straus (1986) for an autonomous regional group from southernmost areas in eastern Asturias, plus 1500–2500 people from the second Iberian group. Estimates for sites on plains to north of the Ardennes have been merged, as it is unclear what their distributions mean demographically. Rozoy identified six distinct population groups in Middle-Upper Magdalenian, separated geographically; each regional group could comprise 1500–2000 people, spread over 30–50 bands of 50–60 people; territories of 50,000 to 200,000 sq. km. 2001: rescaled earlier calculations to account for Delpech's (1999) population density estimates. Only three French regions specifically mentioned, and re-scaled using Delpech's (1999) density of *c.* 17 persons per 100 sq. km.
Bocquet-Appel & Demars (2000):	Based on archaeological site data (numbers/densities, sizes, occupation duration, etc.). Division between Viable areas (including now-submerged land) and Coinciding Surfaces (i.e. above modern sea-level: perhaps more useful in obtaining population densities, given that very few submerged archaeological sites have been found?). Demographic modelling incorporates ethnographic studies of climatically similar hunter-gatherers.
Maier & Zimmermann (2017); Maier (2017); Maier et al. (2016); Schmidt & Zimmermann (2019):	Integration of climatic, ethnographic and archaeological data for four main phases (earlier and later Gravettian, Solutrean/Badegoulian (LGM) and Magdalenian). Archaeological sites are plotted on maps, analysed with Thiessen polygons and largest empty circles (to measure site densities), and combined with other data (e.g. raw material provenancing patterns (exchange assumed to reflect aggregation phases in fission-fusion cycles) and ethnographic group size data from selected foraging groups (direct counts of numbers per group). Focus on median and interquartile range values. Median aggregation group size from extant hunter-gatherers taken to be 43 people.

Table 9.C2. *Characterizing two colonizing strategies (Beaton 1991: 216).*

	Transient explorers	Estate settlers
Demography:		
Budding threshold	Low	High
Group composition	Stable	Slightly fluid
Inbreeding	High	Low
Fecundity	Low	High
Extinction probability	High	Low
Economy:		
Different ecological zone tolerance	High	High
Estate	Unconstrained	Bounded
Archaeology:		
Site forms	Very similar	Varied
Tool inventory	Generalized, conservative	Specialized, inventive
Range of activity/site	Repetitive	Varied
Strategy	Forager/pursuer	Collector/searcher
Colonizing logic:		
Diet breadth	Narrow	Wide
Geometry	Lineal	Bow-wave/radial
Ecology	Patch-similar	Cross-patch

These modelled pioneer/transient explorer (highly mobile) groups (Table 9.C2) share many characteristics with Bettinger's (1991) 'Travellers': briefly occupied and widely spaced settlements, low population densities and high sensitivity to demographic change, and the major subsistence costs being travel, search and scouting. Such groups would live well below the environmental carrying capacity, ensuring their competitive fitness was low. Bettinger's 'Processors' exist closer to the environmental carrying capacity (thus competitive fitness is high), and exploit a broad spectrum of resources (the major subsistence costs are procurement and processing of resources), have groups rich in females, and live at high population densities for extended periods in closely spaced settlements. Such economies might reflect more intensive, post-dispersal residential occupations seen in all phases of the Upper Palaeolithic, with lower motility (*sensu* Weig 2015) and restricted (e.g. circulating/tethered) mobility. The durability and nature of any resource 'hot-spots' would determine whether they would generate contests rather than scrambles (Boone 1992), and underpinning any value attached to them would be knowledge exchange and network structure.

Upper Palaeolithic refugia (Table 9.C3) would represent the opposite process to dispersal, whereby preferred resources and conditions contracted and/or shifted spatially, forcing demographic reorganization and possible local extirpation of groups. Whether populations were expanding/dispersing or contracting, it is not self-evident that resource selectivity was narrow or broad spectrum, respectively (*contra* Beaton 1991; Bettinger 1991). There might have been situations where relatively unspecialized diets (tracking familiar resources in selected patches/biomes) would have provided more reliable food for dispersing populations, and refugial conditions might have arisen among Processor groups specializing in a restricted number of food taxa.

Evidence for highly predictable and defensible/divisible resources that would sustain 'Political networks' (see Fig. 9.5: G) is at best ambiguous for the

Table 9.C3. *Population Events for MOIS-2 Western Europe (after Gamble et al. 2005). Similar events cannot yet be identified in MOIS-3, owing to restricted numbers of reliable dates, sigma values spanning climatic fluctuations, and uncertainties about the specific hominin authors of some technocomplexes. Solutrean assemblages would fall within Population event 1, while sites such as Maszycka cave (Population event 2) and Pincevent (Population event 3) would have fallen within expansionary phases. The Ahrensburgian of Stellmoor fell within Population event 5. [See main text for more discussion.]*

Population event	Settlement pattern	Phylogeography	GRIP stratotype	GRIP ice-core years (ka) BP
1: Refugium	Dispersed	Low population size	LGM – GS-2c	25 – 19.5
2: Initial expansion	Pioneer		GS-2b – GS-2a	19.5 – 16
3: Main expansion	Residential	Founder effect and expansion	GS-2a – GI-1e	16 – 14
4: Stasis	Nucleation		GI-1d – GI-1a	14 – 12.9
5: Contraction			GS1	12.9 – 11.5

Upper Palaeolithic. The remaining three networking options (see Fig. 9.5: E, F, H) seem likelier, but are difficult to map directly onto technocomplexes. This is because the networking criteria used by Fitzhugh et al. test our expectations for Upper Palaeolithic demographies: were dispersing/colonizing groups more likely to have had open, exogamous, networks (Fig. 9.5: E), or ones intermediate between open and closed (Fig. 9.5: F)? Such strategies would have enabled reduction of the risks of dispersing into unfamiliar landscapes, e.g. evidence of early modern humans interbreeding with Neanderthals in Eurasia (Fu et al. 2014, 2015). Dispersing groups that moved as discrete, closed, networks, where endogamy and lack of information exchange with other groups were normal, would encounter problems of demographic sustainability (cf. Prüfer et al. 2014; Sikora et al. 2017). It is conceivable that such groups might have been forced into endogamy/inbreeding and closed interactive networks by the lack of other groups in the areas they were dispersing through (i.e. 'empty' landscapes), or through encountering groups with closed, territorial networks; such situations would have rendered these groups particularly vulnerable to major environmental deteriorations. As more residential 'infill' occupation of landscapes occurred after initial dispersal (Table 9.C3), one might expect interaction costs to decline as populations became more stable, allowing more intensive use of environmental resources (derived from greater adaptive depth and detailed local knowledge) and a wider range of marriage systems.

An individual would have had different motility potentials across their lifespan or between seasons/years, which may or may not have spatio-temporally coincided with those of other group members. Various activities (resource processing and storage, ceramic technology, funerary practices, etc.) might also serve to restrict mobility, at least temporally, for some individuals. 'Scouting' or 'walkabouts' by individuals with fewer ties to a location (e.g. unmarried, no children) might have served to track preferred resources in unoccupied landscapes, rather than population pressure pushing whole bands gradually forward in a wave-of-advance (Beaton 1991; Davies 2001).

APPENDIX D: SUNGHIR CASE STUDY

Table 9.D1. *Summary information for the Sunghir remains (56.176°N, 40.502°E). Data from Trinkaus et al. 2014; Trinkaus & Buzhilova 2012, 2018; Alexeeva et al. 2000; White 1993; Bosinski 2015. Dates from Marom et al. 2012; Dobrovolskaya et al. 2012; Nalawade-Chavan et al. 2014; Trinkaus et al. 2014, 11. Date corrections (CalPal2007_HULU) given at 2σ (95 per cent) (www.calpal.de). aDNA from Sikora et al. 2017.*

Specimen	14C date	Estimated age at death	aDNA	Grave goods	Notes
Sunghir 1 (grave 1)	OxA-X-2464-12: 28,890 ± 430 (hydroxyproline) [CalPal: 32,290–34,362 cal. BP]; KIA-27006 (femur): 27,050 ± 210 (ultrafiltration) [CalPal: 31,462–32,118 cal. BP].	35–45 years (Trinkaus et al. 2014) [cf. late 40s/ early 50s according to Trinkaus & Buzhilova (2012: 655)]	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U8c.	Variable staining with ochre on the body; especially rich on the cranium. ≥2936 subrectangular, rounded and subrectangular/oval beads/pendants; 'tens' (Trinkaus et al. 2014: 17) of perforated arctic fox canines, twelve on the forehead. A small pear-shaped schist pendant (painted red, with a small black dot on one side) on chest and 25 ivory rings/'bracelets'. A few lithic tools, some of which were located between the femora.	Clear burial pit. Adult male buried in a full set of inner and outer garments, as well as headgear. Perimortem wound (10 mm long, 1.1–2.2 mm wide and 6.5 mm deep) to first thoracic vertebra, caused by a sharp, thin object entering the body adjoining the left clavicle: no evidence of healed bone. Very worn teeth, especially on upper molars (less on the lower molars): the cause of this non-masticatory specific wear is not known. Calculus present on teeth. Microwear on molars suggests a significant plant (starch) consumption, as well as meat. High concentrations of zinc suggest a diet rich in vertebrate protein. Osteoarthritis in thumbs, midcarpals and wrists: in part related to activity levels and joint overloading (not simply age-related). Faint Harris lines on distal radii and partial ones on tibiae: remnant adolescent stress?
Sunghir 2 (grave 2)	OxX-2395-6: 30,100 ± 550 (hydroxyproline) [CalPal: 33,308–35,280 cal. BP]; OxA-15753 (tibia fragments): 25,020 ± 120 (ultrafiltration) [CalPal: 29,475–30,503 cal. BP].	*c.* 12 years	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U2.	Few bones show ochre-staining; concentrated on the skull, shoulders and left ilium. 1 massive ivory lance (2.47 m long and several kg) along his right side (and continuing along the left-hand upper body of Sunghir 3). An ivory disc, with latticework carving, standing upright on its edge in the soil: perhaps mounted over the tip of a now-decayed (wooden?) lance. 4903 ivory beads, of the same forms (but roughly 2/3 smaller) as seen in grave 1), plus a string of very small and thin beads (*c.* 1 mm thick) beneath the pelvis; ≥40 perforated arctic fox teeth on top of the head, mixed in with ivory beads; the remains of a decorated belt (>250 pierced arctic fox canines). An ivory pin at his throat (fastening for a cloak?), and an ivory indeterminate animal figurine on his chest. A large ivory mammoth sculpture was under his left shoulder, and Sunghir 4 was laid beside his left arm. ≥8 ivory 'bracelets' on his arms. A small tubular bead (from a bird bone?) was found in his upper left torso.	Grave 2: two immature individuals buried head-to-head in an elongated burial pit. Left forearm and hand bones of Sunghir 2 appear to be missing (no adornments in that area of the body either). Possible perimortem trauma in middle of left ilium: angular edges to the hole (fatal, if a wound from the front?). Very little tooth-wear (little more than polish): weak chewing and/or soft food? Weakly developed muscle insertions on head and body. Flat upper face and nasal bones slope sharply downwards: unlike faces of other Sunghir individuals. Calculus present on teeth. Microwear on a premolar and molar implies significant plant (starch) consumption, with lower meat consumption than seen Sunghir 1 and 3. Concentrations of zinc are also lower than Sunghir 1, 3 and 4, implying a lower consumption of vertebrate protein. At least one stress event documented in the teeth (linear enamel hypoplasias): at least two months in duration between age of about 2.5 and 3 years (subsequent stress periods between age of 3 and 5, but little sign of stress after that age). Weak evidence of stress-related growth disruption in long bones: one faint Harris line in proximal end of right fibula. Bone remodelling occurred after the age of five? A void in one thoracic vertebra: possibly a localized benign cyst or a parasitic infection.

Table 9.D1 *(cont.)*.

Specimen	14C date	Estimated age at death	aDNA	Grave goods	Notes
Sunghir 3 (grave 2)	OxX-2395-7: 30,000 ± 400 (hydroxyproline) [CalPal: 33,190–35,142 cal. BP]; KIA-27007 (humerus): 26,000 ± 410 (ultrafiltration) [CalPal: 30,071–31,831 cal. BP]; OxA-15751 (tibia fragments): 25,430 ± 160 (ultrafiltration) [CalPal: 29,640–30,912 cal. BP]; OxA-15754 (tibia fragments): 24,830 ± 110 (ultrafiltration) [CalPal: 29,255–30,463 cal. BP].	*c.* 10 years	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U2.	More extensive ochre-staining than seen for Sunghir 2: concentrated on the skull, shoulders, left ilium (with a thick layer of ivory beads) and right leg. 5274 ivory beads, plus another *c.* 115 preserved in the ochre on the ilia and 6–12 mixed with the hand bones; roughly 2/3 size of those from grave 1. No pierced arctic fox canines, nor a pendant on the chest. ≥13 ivory 'bracelets' on his arms. 2 pierced antler batons, one decorated with rows of drilled dots (White)*, at his side. Smaller ivory lances than seen alongside Sunghir 2 (scaled down?). 3 ivory discs (one small and two much larger) with a central hole and carved latticework, like that adjacent to Sunghir 2. The small disc was to the left of his head, while the other two were at his sides, accompanying the pointed ivory shafts (one of whose points was inserted into the central perforation of one of the larger discs; a *c.* 15 cm long linear array of microflakes from the disc to the lance tip might indicate armatures.	Relatively short femora (in comparison to the humeri and tibiae), which have very pronounced anterior curvature/bowing. Unlikely to derive from rickets, as symmetrical, so thought to be congenital. Sunghir 3 is more robust than Sunghir 2, even though younger at time of death, and his muscle insertions are also more robust. Seems to have been an active member of the group, with indications in the skeleton that his mobility was not constrained. More tooth wear than seen in Sunghir 2. Microwear studies of his molars suggest high carnivory (higher than seen in Sunghir 1 and 2), and this is supported by high concentrations of zinc: a diet rich in vertebrate protein. There is evidence in the teeth for at least three separate stress events between the age of 1.5 and 5.6 years. Stress seems to have been generally persistent for his first five years of life, varying in intensity not presence. Harris lines in the femora (7 lines in each) and tibiae (2 lines in each) likewise suggest that Sunghir 3's systemic stress continued until his death (reflecting either serious resource fluctuations, or his general frailty). High levels of calcium in the bones might reflect this individual's systemic abnormalities.
Sunghir 4 (grave 2)	OxX-2462-52: 29,820 ± 280 (hydroxyproline) [CalPal: 33,518–-34,646 cal. BP].	20s/30s	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U2.	Bone surface is highly polished (intentionally, or from repeated handling?), and medullary cavity filled with ochre. Broken proximal and distal ends are irregular (resemble dry bone breaks), though also appear burnished (from handling?). Spatially associated with Sunghir 2.	Very robust human femoral diaphysis, with missing proximal and distal ends (from lesser trochanter to mid-distal diaphysis). A smaller individual than Sunghir 1, and isotopic signature (e.g. very low levels of calcium) in the bone implies a different geographic origin for him, and/or a different postmortem history. Otherwise, the bone appears healthy.
Sunghir 5	OxA-X-2666-52: 26,042 ± 182 (amino acids) [CalPal: 30,288–31,692 cal. BP].	30s/40s (similar to Sunghir 1?)	Poor endogenous aDNA yield.	Associated with a large flat stone, abundant ochre, an arctic fox canine and an ivory rough-out/blank for a bead (latter two might derive from the cultural layer, rather than have been specifically deposited with the skull).	Isolated cranium: disturbed burial (ice-wedge and solifluction evidence immediately adjacent)? Found in cultural layer above grave 1 (sq. P-157). Healed minor traumatic lesion over right orbit. Some (age-related) periodontal degeneration.

Table 9.D1 *(cont.)*.

Specimen	14C date	Estimated age at death	aDNA	Grave goods	Notes
Sunghir 6 (cultural layer)	OxA-31755: 884 ± 23 (ultrafiltration) [CalPal: 703–943 cal. BP]; OxA-X2653-36: 925 ± 29 (hydroxyproline) [CalPal: 761–945 cal. BP].	Younger adult (in 20s)?	Male (Y-DNA haplogroup I2a1b2); mtDNA haplogroup W3a1.		Partial mandible from cultural layer above grave 2; date indicates historical age. No lesions: healthy bone.
Sunghir 7		Adolescent/ young adult?			Now lost. Partial femur from between graves 1 and 2, in the cultural layer. Possibly female?
Sunghir 8		16–17 years (mid to late adolescent)?		Unclear if grave goods were incorporated in the burial (no artefacts were found).	Very fragmentary, and now lost: cranial fragments and a crushed femur were recovered *c.* 200 m south of grave 2. Probably from a grave dug into sediments below cultural layer. Possibly female.
Sunghir 9					Skeleton; now lost. Found in a quarry southeast of Graves 1 and 2, in 1972.
Sunghir 10 (grave 2bis)		Adult		Partially covered in ochre. 3 perforated schist pendants; ivory beads; perforated arctic fox canines, small bone tubes, a bone awl; a finely worked biface; 18 cm-long worked mammoth tusk, a small ivory ring; a worked fossil mollusc shell; 2 reindeer antler 'clubs'.	Buried in an extended position; very deteriorated remains. Found within the cultural layer (hence its poor preservation?). Immediately overlies grave 2 (Sunghir 2 and 3).

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Social inequality before farming?

Archaeological investigations over the past 50 years have challenged the importance of domestication and food production in the emergence of institutionalized social inequality. Social inequality in the prehistoric human past developed through multiple historical processes that operate on a number of different scales of variability (e.g. social, economic, demographic, and environmental). However, in the theoretical and linguistic landscape of social inequality, there is no clear definition of what social inequality is. The lifeways of hunter-gatherer-fisher societies open a crucial intellectual space and challenge to find meaningful ways of using archaeological and ethnographic data to understand what social inequality exactly is with regard to variously negotiated or enforced cultural norms or ethoses of individual autonomy. This interdisciplinary edited volume gathers together researchers working in the fields of prehistoric archaeology and cultural and evolutionary anthropology. Spanning terminal Pleistocene to Holocene archaeological and ethnographic contexts from across the globe, the nineteen chapters in this volume cover a variety of topics organized around three major themes, which structure the book: 1) social inequality and egalitarianism in extant hunter-gatherer societies; 2) social inequality in Upper Palaeolithic Europe (*c.* 45,000–11,500 years ago); 3) social inequality in prehistoric Holocene hunter-gatherer-fisher societies globally. Most chapters in this volume provide empirical content with considerations of subsistence ecology, demography, mobility, social networks, technology, children's enculturation, ritual practice, rock art, dogs, warfare, lethal weaponry, and mortuary behaviour. In addition to providing new data from multiple contexts through space and time, and exploring social diversity and evolution from novel perspectives, the collection of essays in this volume will have a considerable impact on how archaeologists define and theorize pathways both towards and away from inequality within diverse social contexts.

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